

**Economic assessment of policy measures for the implementation of the Marine  
Strategy Framework Directive**

**Contract N° 070307/2010/577902/ETU/F1**

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## List of abbreviations and acronyms

ALDFG	Abandoned, lost or otherwise discarded fishing gear
ALSF	Aggregates Levy Sustainability Fund
BAA	British Aggregates Association
BMAPA	British Marine Aggregate Producers' Association
BSNN	Black Sea NGO Network
BPO	Baltic Ports Organisation
BSPA	Baltic Sea Protected Area
CAC	Command-and-Control (instruments)
CBA	Cost-Benefit Analysis
CBI	Confederation of British Industry
CEA	Cost-effectiveness Analysis
CMP	Wageningen University – Centre for Marine Policy
CEFAS	Centre for Environment, Fisheries & Aquaculture Science
CNR	Consiglio Nazionale delle Ricerche - Istituto di Scienze Marine
CCS	Conservation Credits Scheme
CCSG	Conservation Credits Steering Group
CCTV	Closed Circuit Television
CFP	Common Fisheries Policy
CIESM	The Mediterranean Science Commission
CIZ	Commercial Impact Zone
CPBSAP	Commission on the Protection of the Black Sea Against Pollution
CPMR	Conference of Peripheral Maritime Regions of Europe
CRP	Cod Recovery Plan
DEFRA	UK Department for Environment Food and Rural Affairs

DNV	Det Norske Veritas
EAERE	The European Association of Environmental and Resource Economists
EEA	European Environment Agency
ECNC	European Centre for Nature Conservation
EEZ	Exclusive Economic Zone
ECSA	European Community Shipowners' Association
EMS	Electronic Monitoring System
EMSA	European Maritime Safety Agency
ESA	EFTA Surveillance Authority. EFTA is the European Free Trade Association with Iceland, Liechtenstein, Norway and Switzerland as members.
ETS	Emissions trading system
FEPORIS	The Port Institute for Studies and Co-Operation in the Valencian Region
FMAC	Fisheries Management and Conservation Group
FRS	Fisheries Research Service
GFCM	General Fisheries Commission for the Mediterranean
GES	Good Environmental Status
GT	Gross Tonnage
HELMPEA	Hellenic Marine Environment Protection Association
HMRC	Her Majesty's Revenue and Customs
IBA	Important Bird Area
ICES	International Council for the Exploration of the Sea
IEEP	Institute for European Environmental Policy
IMADP	Interim Marine Aggregates Dredging Policy
IMARES	Institute for Marine Resources and Ecosystem Studies
IMO	International Maritime Organisation
ITQ	Individual Transferable Quota

IUCN	International Union for Conservation of Nature
LNG	Liquid Natural Gas
LPOC	Last Port of Call
LPUE	Logged Per Unit Effort
MALSF	Marine Aggregates Levy Sustainability Fund
MCA	Multi-Criteria Analysis
MEDSOS	Mediterranean SOS Network
MEPF	Marine Environmental Protection Fund
MIO-ECSDE	Mediterranean Information Office for Environment, Culture and Sustainable Development
MPA	Marine Protected Area
MSC	Marine Stewardship Council
MSFD	Marine Strategy Framework Directive
MS(S)	Marine Scotland (Science)
NGO	Non Governmental Organisation
NSINAS	National Scientific Institute of the National Academy of Sciences, Ukraine
NEFCO	Nordic Environment Finance Corporation
NOK	Norwegian Kroner
NSF	No Special Fee (system)
OECD	Organization for Economic Co-operation and Development
OSPAR	OSPAR is the mechanism by which fifteen Governments of the western coasts and catchments of Europe, together with the European Community, cooperate to protect the marine environment of the North-East Atlantic.
PRF	Port Reception Facilities
QPA	Quarry Products Association
Quango	Quasi-autonomous Non-Governmental Organisation
PAP/RAC	UN Priority Actions Program/Regional Activity Centre

PECSD	Public Environmental Centre of Sustainable Development - Bulgaria
PEIN	Plan de Espacios de Interés Natural (Natural Interest Areas Plan)
RCII	Relative Cod Importance Index
RES	Refunding of Emission Payments
RSPB	Royal Society for the Protection of Birds, UK
RTC	Real Time Closure
SAC	Special Area of Conservation
SCR	Selective Catalytic Reduction
SFF	Scottish Fishermen's Federation
SFPA	Scottish Fisheries Protection Agency
SINTEF	large independent research organisation in Scandinavia
SPA	Special Area for Birds
SPAMI	Special Marine Areas of Mediterranean importance
SYKE	Finnish Environment Institute
UBC-net	The University Of British Columbia Fisheries Centre
UNEP	United Nations Environment Programme
UNEP MAP	Mediterranean Action Plan
VMS	Vessel Monitoring System
WFD	Water Framework Directive
WRAP	Waste and Resources Action Programme
WWF	World Wildlife Fund, later changed to World Wide Fund For Nature in some regions. In 2001, it was agreed on using the original acronym as the one, global name.

## Introduction

The quality of marine waters and the ecosystem services generated by them are increasingly seen as being of importance to decision makers. With the emergence of policy guidance from the European Commission in the Marine Strategy Framework Directive (MSFD), the Water Framework Directive (WFD) as well as regional integrated coastal zone management, decision makers are increasingly aware of the importance of knowing how the environmental conditions of marine waters are changing. In particular, there is a desire to appreciate the value to our societies of changes in marine waters, in order that policy may weigh the costs and benefits of actions and / or compare to other policy objectives (e.g. reducing air pollution).

The aim of the MSFD is to protect more effectively the marine environment across Europe. Member States - cooperating with other Member States and non-EU countries within a marine region - are required to develop strategies for their marine waters. These marine strategies must contain a detailed assessment of the state of the environment, a definition of "good environmental status" at regional level and the establishment of clear environmental targets and monitoring programs. When the marine environment in a Member State does not reach the set environmental targets, specific measures tailored to the particular context of the area and situation will need to be elaborated.

EU Member States are facing different challenges in preparing their program of measures to achieve or maintain good environmental status (GES) of their marine environments (ecological situation but also considering their economic, social and regulatory situation). This study therefore includes building elements for Member States to facilitate the process of choosing a package of measures to achieve the targets set for their marine environment, or more specifically in terms of MSFD, to prepare a program of measures.

This guidance consists of an inventory of possible measures, their assessment according to a set of criteria (e.g. cost, effectiveness, benefits, feasibility) and the identification of key success / limiting factors for each measure or group of measures. The collected evidence could support Member States to compile a set of measures suited for their own implementation of the MSFD. The outcome of this study should also help streamlining discussions between Member States of the same region and between Member States and the Commission on what direction to take in developing such a program of measures (by 2015).



## 1 Inventory of measures

The first part of the study presents an inventory of measures that could satisfy the list presented in Annex VI of the MSFD and that could potentially address the indicative pressures and impacts listed in Annex III of the directive.

This inventory is based on a review of published literature as well as interviews with a large number of relevant institutions, aimed at gathering as much as possible (also unpublished) information about specific instruments and their evaluation. The inventory is presented as a database (Excel format) including all collected information for the identified measures.

The next paragraph 1.1 provides an outline of the framework that has been used to structure the inventory exercise and to define boundaries for the identification of measures. Section 1.1.1 gives an introduction on the types of measures included in the inventory, followed by the key pressures for the different regional seas around Europe (section 1.1.2).

Background information on the structure of the inventory is further described in paragraph 1.2. This additional description helps to explain the logic of the database as it is intended to serve as a supporting tool for Member States in selecting appropriate measures for their own marine environment. The results of the inventory exercise are then further detailed in paragraph 1.3.

### 1.1 Framework and scoping of the inventory exercise

The basis for the proposed research strategy and framework for the identification of measures lies in the Marine Strategy Framework Directive. The inventory of measures builds on the linkages between, on one hand, pressures and impacts on marine environment and the uses made of it and, on the other hand, measures to maintain or achieve the Good Environmental Status (GES). These linkages are partly illustrated in the following Figure.

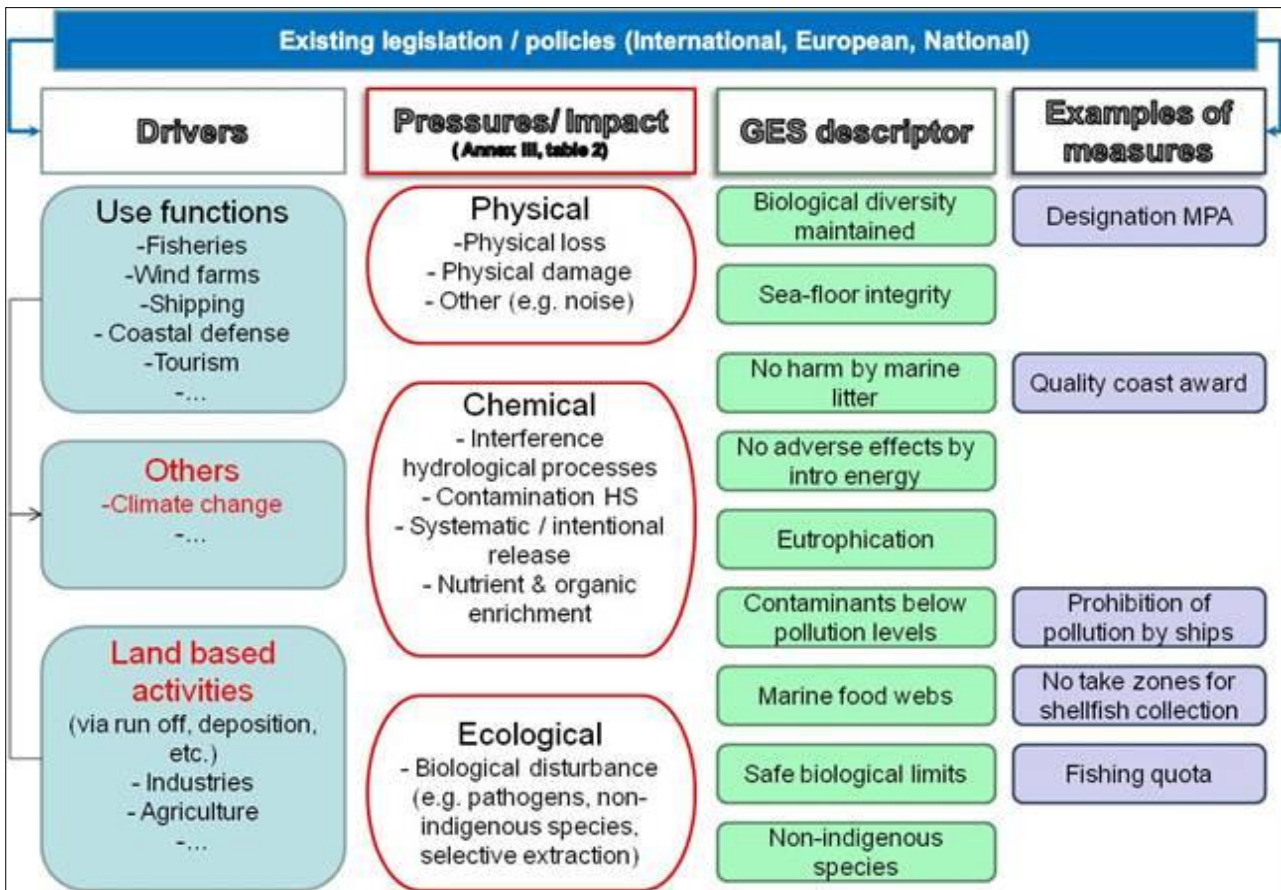


Figure 1: Framework for inventory building

The identification of measures to improve or maintain the environmental status of the marine environment focuses on the EU-level. Many primary pressures impacting the marine environment are already tackled by current legislation and ongoing policy commitments at different regional scales (EU, national, international), e.g. the Water Framework directive, Nitrates Directive or Habitats or Birds Directive, etc.

Within this study, measures originating from good implementation of existing legislation are not targeted by the inventory exercise, as the ecological benefits they aim at are assumed to be accomplished anyway (within the time framework of MSFD). Measures should thus be included if they go **beyond existing legislation**, with the timing of this legislation being **congruent with the timeframe** of the MSFD<sup>1</sup>. The following practical approach for further definition of the scope will be used:

- The inventory exercise aims at identifying measures that tackle at least the **most important pressures** in the different regional seas<sup>2</sup>. A brief assessment of the main pressures is presented in section 1.1.2.
- The focus is on the most important pressures and sectors from which these pressures stem. For these relevant pressures, it has been attempted to take up at

<sup>1</sup> E.g. The timing of the Common Fisheries Policy goes beyond the timing of the MSFD, which makes measures in the fisheries policy field with positive effect for the achievement of MSFD goals relevant to be integrated in the database.

<sup>2</sup> Key pressures are identified through both literature and expert interviews.

least a measure that is / could be developed to influence the sector / user (incl. land-based sectors) primarily responsible for it.

- Next to existing measures, the study aims at identifying some measures from policy areas not directly related to water (e.g. waste, agriculture) or new developments (e.g. technical innovation) that could have a positive impact on the marine environment and / or could be applied to it, and could therefore be interesting options for Member States. Possible examples could be the implementation of habitat banking or alternative payments for ecosystem services. The evaluation of the feasibility and potential is difficult as the implementation of such measures is premature or not existing, even outside the EU.

### 1.1.1

#### Define the typology of measures

The inventory gives specific attention to economic (Market-Based Instruments) measures, but non-economic measures are also included. The measures can be implemented at different spatial levels (local, national, regional or global level).

The inventory exercise resulted in following typology of measures:

- Traditional command and control instruments
- Economic instruments
- Social instruments
- Technical, technological or research oriented measures

**Command-and-control** or regulatory instruments (CAC) have a direct influence on the behavior of actors by imposing rules that limit or prescribe the actions of the target group. Examples of such instruments are regulation (including spatial and temporal controls, zoning), norms and standards, bans, .... These instruments have a legal basis and enforcement and control is a key element in the success of the instrument.

**Economic or market-based instruments** are defined by the OECD as tools that 'affect estimates of the costs and benefits of alternative actions open to economic agents'. The common underlying rationale is to modify the behavior and decisions of actors and individuals to enhance the protection of the environment, to secure an optimal level of pollution or to achieve optimum rates of resource use and depletion, e.g. inspired by the polluter-pays principle (Matthei et al, 2009)<sup>3</sup>. Or to put it more simply, if a tool affects the cost or price in the market, it is a market-based / economic instrument. This definition focuses on the economic signals and incentives. If it changes the cost or price of a good (e.g. plastic bags), service (e.g. waste collection), activity (e.g. waste dumping), input (e.g. materials), or output (e.g. pollution) then it is a market-based instrument. Economic instruments have both an incentive-effect and a revenue-raising effect, with the relative importance depending on the ability of the market to respond to the "price signal".

Examples of such instruments are fee-based systems, subsidies, liability and compensation regimes and trading systems. Subsidies are often easy to implement as

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<sup>3</sup> Matthei, V., Le Mat, O. Strosser, P. (2009). Which role for economic instruments in the management of water resources in Europe? A study undertaken for the Ministry of Transport, Public Works and Water Management, The Netherlands

the (political) acceptance is high. Subsidies can involve significant use of government finance and their success relies on the behavior of the target group. The other risk of subsidies is that they may turn out to be environmentally harmful – e.g. if subsidies for fishing gear lead to increased fishing effort and depleted stocks this would be an example of an environmentally harmful subsidy in the marine case.

Like economic instruments, **social instruments** influence or provoke the desired behavior indirectly. A key feature of this type of instruments is the voluntary aspect of actions. Polluters or stakeholders are stimulated to take actions based upon own motivation, often through information (education, training) or awareness raising campaigns. Good or bad image building and associated perception from society (e.g. through communication or certification) can provide important incentives to adapt behavior.<sup>4</sup>

The **technical, technological or research oriented measures** refer to the physical measures having a direct impact on the environment. **A physical measure may be carried out by any stakeholder, whereas an instrument is usually created by the governmental level.** The assessment of costs and effects of physical measures tend to be more straightforward compared to the evaluation of policy instruments, because there is a more direct link between the action and the result<sup>5</sup> (however still related to a specific context). Information on effects, costs and factors influencing the success of measures are included whenever available from the identified sources. Paragraph 1.3 provides a summary of the type of measures and information included in the inventory.

Examples of **technical, technological or research oriented measures** are mitigation and remediation tools addressing the pressures in the EU regional seas. It should be clear that there is a link with policy instruments. If there is an obligation to imply a certain technical measure, it should be regarded as a regulatory instrument. The implementation of certain technical measures can be encouraged by subsidies, which in turn can be supported by resources generated by taxes/levies. If an information campaign promotes the application of the technical measure, it should be regarded as a social instrument.

It is sometimes difficult to categorize a measure as a technical measure or as a regulatory measure, e.g. in situations where there is no information if the measure is already imposed by authorities or whether private stakeholders can take it voluntarily. Examples of such measures are:

- Detailed location planning (cables, pipelines, drilling)
- Delineation of extraction zones
- Seabed restoration or aftercare measures
- Removal of man-made constructions
- Monitoring activities

For the inventory, measures regarding planning or location instruments (first two bullets from the above listed measures) are considered as command-and-control instruments as these are often embedded in environmental permitting procedures, initiated by

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<sup>4</sup> Budding, B., Gauderis, J., Mulder, K. (2009). De maatschappelijk-economische consequenties van het gebruik van economische instrumenten in het waterbeheer. RWS - Waterdienst.

<sup>5</sup> P.c. Rob Van Der Veeren, Dutch Ministry of Transport and Water

authorities. The latter three have been classified as technical or research oriented measures for the purposes of this inventory. These measures might be executed by either the polluter or (funded) by the authorities e.g. monitoring activities (post-operational, seismic surveys, monitoring activities to enhance knowledge – research - on impacts and required future measures, ...) and are as such not necessarily regulatory instruments. It is of note that authorities often impose these measures and make them mandatory (Command-and-Control).

### 1.1.2 Define regional priorities: key pressures and uses of the European regional seas

Based upon recent assessments of the current state of the marine environment in the European seas, the key pressures or priorities for each of the regional seas have been summarized. The presented descriptions rely on ad hoc screenings of the extensive publications and do not aim to be exhaustive or complete. We refer to each of the specific publications for further detailed reading on the state of the marine environment in each of the considered regional seas. These paragraphs mainly serve as a scoping guidance for the comprehensive inventory of marine measures. Additionally in the expert interviews, the interviewee has been asked to provide own insights on the key pressures in the considered sea or region.

#### 1.1.2.1 The North Sea

In the recently published OSPAR Quality status report (2010), ongoing concerns with regard to the North Sea are:

- **Eutrophication** on the coasts: Nitrogen inputs, largely from agriculture, are the biggest cause. Furthermore, it can take decades before reduced nutrient inputs benefit the marine environment. The role of shipping emissions on the busy North Sea routes can't be ignored, considering the even increasing importance of maritime traffic in the future.
- Pollution with **hazardous substances**: Concentration of heavy metals (cadmium, mercury, lead) and POPs above background in some offshore waters and unacceptable in some coastal areas (e.g. levels of lead, PAHs and PCBs at unacceptable levels at 40 or over 50 % of the monitoring sites).
- Fishing: Some important North Sea fish stocks outside sustainable limits (cod in particular). By-catch of ray, sharks, porpoises and dolphins is also of concern. Also possible by-cause (**overfishing** of key prey species) of breeding failure of seabirds.
- **Seabed habitats**: fishing practices (beam trawling). In the western Channel, extraction of red calcareous seaweed (maerl) for use as an agricultural soil conditioner.
- **Marine litter**: plastics. Beach litter in southern North Sea at OSPAR-wide average but levels are higher in the northern North Sea. In the North Sea, it appears that half of the litter originates from ships.
- Responses to climate change: wind farms (response), development of coastal defense, sand extraction for beach nourishment. Norwegian Sea, proposed sites for sub-seabed storage of CO<sub>2</sub>.
- One of the busiest shipping lanes in the world.

The interviews confirm these key pressures as still being prevalent.

For the purpose of this report, the key elements have been summarized in following table using the defined pressures (Annex III table 2) of the MSFD. This exercise is a crude approach only and has not been verified with expert organizations.

Table 1 : Key impacts, pressures, uses/sectors in the North Sea

Impact	Pressure	Use / sector	Comments
Physical damage	Selective extraction	Aggregate extraction	The pressure also originates from coastal defense and beach nourishment
Physical damage	Abrasion	Commercial fisheries	
Other physical disturbance	Marine litter	Shipping (fisheries and maritime transport) Land-based sources	Shipping responsible for +/- 50% of marine litter
Nutrient and organic matter enrichment	Input of fertilizers	Agriculture	
Contamination by hazardous substances	Non-synthetic substances (heavy metals, POPs)		Different sectors
Biological disturbance	Selective extraction	Commercial fisheries	Overexploitation and by-catches

Most of the listed pressures are confirmed by a study of the Belgian federal government presenting a semi-quantitative assessment for uses of and pressures on the Belgian marine waters (Arcadis, 2010). The exercise for Belgium also identified significant pressures from dredging and the construction and dismantling of wind farms. It is of note that pressures will vary according to the considered area.

### 1.1.2.2

#### The Baltic Sea

The most important pressures, impacts and sectors in the Baltic Sea have recently been described in the HELCOM initial holistic assessment (HELCOM, 2010). The assessment gives the clear message that none of the open-water basins currently is in a 'good environmental status'. Most sea areas are affected by eutrophication, hazardous substances or an unfavourable conservation status. Human-induced pressures on the Baltic Sea urgently need to be managed intelligently, especially pressures caused by agriculture, fisheries, industries, and the maritime sector, but also by ordinary people, because after all it is our lifestyle which is the root cause of all pressures affecting the marine environment.

Ranking of the magnitude of all potential pressures on the Baltic Sea has been based on the (Baltic Sea) Impact Index values (HELCOM, 2010: HELCOM initial holistic assessment). The sum value of each pressure depends on the spatial coverage of the potential impact, the intensity of the potential impact and the constants used for evaluating the severity of the impacts of pressures on the local ecosystem components. Most prominently, the marine environment is under pressure by anthropogenic loads of

nitrogen, phosphorus, organic matter (leading to eutrophication), and hazardous substances. But commercial fishing is also a strong and widespread user which severely impacts the Baltic Sea ecosystem (biological disturbance).

Pressures causing **eutrophication** are mainly related to inputs of nutrients from external sources, whether via water or air, and to a lesser extent internal sources such as sediments that have retained anthropogenic inputs from the past. Pressures causing **contamination** and **pollution effects by hazardous substances** are either related to the inputs of synthetic or natural compounds from external sources, whether via water or air, or to inputs from contaminated bottom sediments caused by physical disturbance of the seabed following, for example, construction activities, dredging or disposal of dredged material. Releases of oil to the marine environment represent a continuous pressure on the Baltic Sea. Releases of oil not only cause pollution effects, but can also directly harm biodiversity (seabirds). The greatest source of eutrophication-causing nutrients and a significant source of hazardous substances are land-based inputs, most notably by agriculture, municipal wastewaters, industry, and poorly managed old dump sites.

Pressures including the **selective extraction of species** by commercial fisheries and by hunting of seals and seabirds directly disturb biodiversity. The greatest concern in this respect relates to the elimination of top predators. Biodiversity is also impaired by numerous types of **physical disturbances** which take place in most, if not all, coastal zones and also in large areas of the open sea. These disturbances include smothering of benthic organisms from disposal of dredged materials, abrasion of the sea bottom caused by bottom trawling and dredging, and changes in salinity or temperature regimes.

Underwater noise and marine litter are forms of physical disturbance which also have the potential to disturb life in the Baltic Sea, but with effects that are less well known.

The same conclusions have been described in a recent article on the Baltic Sea region by Jacqueline McGlade, Executive Director of the European Environment Agency (2010).<sup>6</sup> An overview for the Baltic Sea is presented in the following summary table.

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<sup>6</sup> The main environmental challenges of the 2010's in the Baltic Sea region". by Jacqueline McGlade, Executive Director of EEA, Expert article 598 Baltic Rim Economies, 29.10.2010 Bimonthly Review 5 2010

Table 2 : Key impacts, pressures, uses/sectors in the Baltic Sea

Impact	Pressure	Use / sector	Comments
Nutrient and organic matter enrichment (= eutrophication)	Input fertilizers Input organic matter	Agriculture, atmospheric deposition (different sectors)	
Contamination by hazardous substances	Synthetic and non-synthetic substances (including oil)	Industry, dump sites, municipal wastewaters, atmospheric deposition (different sectors), shipping	Deposition of heavy metals for example
Biological disturbance	Selective extraction of species	Commercial fisheries	Overexploitation and by-catches, elimination of top predators
Physical loss	Smothering	Dredging (disposal)	Further impact on biodiversity
Physical damage	Abrasion of sea bottom	Fisheries, dredging	Bottom trawling and dredging operations

### 1.1.2.3

#### The Mediterranean Sea

The Mediterranean covers more than 2.5 million square km, with a 46,000 km coastline. Its waters join the coastlines of countries in Europe, the Middle East and North Africa, making the region politically, economically and geographically complex as well as environmentally unique and diverse. In brief, it is a sea with unique challenges.<sup>7</sup>

Particular pressure comes from tourism, urban concentration in coastal areas, the development of irrigated and intensive agriculture, overfishing and intercontinental (Asia/Europe) maritime transport<sup>8</sup>.

According to UNEP/MAP-Plan Bleu (2009) there has been some progress as regards marine pollution in particular, very significant efforts still have to be made however in order to manage as efficiently as possible natural resources that are scarce or unequally distributed. Local marine pollution from cities, the industry and tourist resorts, is large, with the significant presence of macro-waste<sup>9</sup> on beaches and in the high seas (**marine litter**). Land-based activities (urbanisation, industry and agriculture) represent the main source of pollution into the Mediterranean Sea, although many uncertainties remain regarding their respective contribution, the different fluxes (rivers, atmosphere, non-point sources, etc.) and the fate of the contaminants they generate (EEA, 1999). In the case of **urban** and **industrial pollution**, the main problem is the rapid population growth along the

<sup>7</sup> <http://www.unepmap.org/index.php?module=content2&catid=001003>

<sup>8</sup> The Mediterranean Sea has the largest traffic density of oil tankers of the globe.

<sup>9</sup> Macro-waste refers to consumption products, containers or packages but also waste from passing ships, from port activities or from fisheries which are nearly unbroken. When the waste is dispersed into pieces, it is referred to as micro-waste. According to UNEP/ MAP (2007), 80% of the macro waste in the Mediterranean Sea originates from land-based sources. UNEP/ MAP (2007). Elaboration of a regional action plan for the management of macro waste in the coastal area of the Mediterranean Basin. Meeting of the MED POL National Coordinators in June 2007.

southern coasts of the Mediterranean, where there are fewer legal instruments and lesser environmental infrastructure investments. The pressure from tourism is one of the problems that have to be managed effectively to avoid any further degradation of the marine and coastal environment.

Nutrient enrichment and **eutrophication** are a major environmental concern particularly for coastal areas close to big cities, industrial agglomerations and river deltas, due to the common practice of untreated or partially treated urban sewage discharge<sup>10</sup> and leaching from fertilized agricultural areas.

After the destruction of habitats, **biological invasions in the marine environment** are the second cause of biodiversity loss. They threaten indigenous species, local economies and public health. The Suez Canal and Mediterranean ports are key sites in the introduction of alien species in the region. Almost half of these species have penetrated the Mediterranean through the Suez Canal, 28 % via marine transport and 10 % via aquaculture. Since 1995, observations show a clear increase in the appearance of such species, with new introductions every 1,3 weeks versus one every 4,5 weeks in 1995.

Fishing in the Mediterranean is characterized by its biodiversity which allows the development of region-specific fauna and fisheries. In the Mediterranean, yearly volumes are limited (1.5 to 1.7 million tons/year), representing less than 1% of global catches, but they are significant in view of the fact that the fishing areas represent less than 0.8% of the world's oceans. After a period of virtually unbridled development, fishing seems to have reached its limits. There is serious cause for concern as regards the **status of economically and commercially important species** (hake, red mullet, common prawn, sole, sardine and tuna), victims of such unsustainable overexploitation. In response to this situation, the General Fisheries Commission for the Mediterranean (GFCM) has implemented measures to restore stocks and to protect vulnerable habitats. Aquaculture has also undergone significant growth since the 90s (seawater fish farming for sea bass, sea bream, and "fattening up" of tuna). However, the development of this activity has directly degraded the quality of the marine environment and habitats.

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<sup>10</sup> Moreover, the rate of collected and treated wastewater through a public sewerage system varies from 7 % to 90 % with very low figures for mainly non-EU countries.

Table 3 : Key impacts, pressures, uses/sectors in the Mediterranean Sea

Impact	Pressure	Use / sector	Comments
Nutrient and organic matter enrichment (= eutrophication)	Input of fertilizers Input of organic matter	Agriculture, urban waste water	Discharges of waste water in coastal areas <sup>11</sup>
Contamination by hazardous substances	Non-synthetic substances (heavy metals, POPs)	Industry: chemical/ petrochemical and metallurgy sectors	Spills and discharges
Contamination by hazardous substances	Non-synthetic substances (oil pollution)	Shipping (fisheries and maritime transport)	Intentional or accidental release by ships
Other physical disturbance	Marine litter	Tourism, densely populated coastal areas Shipping (fisheries and maritime transport)	30–40 million tonnes per year come from the coast, including household waste, paper, glass, and plastic which accounts for 75% of waste in the sea. Intentional release of litter by ships and accidental loss of gear
Biological disturbance	Selective extraction of species	Commercial fisheries	Overexploitation, discards and by-catches
Biological disturbance	Introduction of non-indigenous species	Suez Canal Shipping	And aquaculture to a more limited extend

#### 1.1.2.4

#### The Black Sea<sup>12</sup>

The Black Sea is one of the most remarkable regional seas in the world. It is almost cut off from the rest of the world's seas, is over 2200 meter deep and receives the drainage from a 1.9 million km<sup>2</sup> basin covering about one third of the area of continental Europe. The only connection to the world's oceans is through the Istanbul Strait, a 35 km natural channel, as little as 40 m deep in places. River water enters the Black Sea from land in over twenty countries, which makes it a complex management area.

The key pressures and causes in the Black Sea area have been derived from the second Black Sea transboundary diagnostic analysis (BS TDA 2007)<sup>13</sup>, the first of which was produced in 1996. The expert team supporting the analysis prioritized key problem areas for the Black Sea by determining the relevance of the problem from the perspective of the present day and 10-15 years in the future. When examining future change, experts were asked to consider the effects of climate change. The scoring activity was based on multiple criteria e.g. transboundary nature of the problem, scale of impacts (economic

<sup>11</sup> 48% of urban centres lack sewage treatment facilities and around 80% of wastewater is disposed of in the sea untreated. (UNEP / MAP website)

<sup>12</sup> See e.g. <http://www.blacksea-commission.org/bssap2009.asp>

<sup>13</sup> Black Sea transboundary diagnostic analysis, May 2007.

terms, the environment and human health), lack of perceived progress in addressing/solving a problem at the national level, reversibility/irreversibility of the problem, ...

Based on this exercise, four priority transboundary problems in the Black Sea were identified. The first priority problem is nutrient enrichment or **eutrophication**: The Black Sea is particularly prone to eutrophication because of its enclosed (land-locked) nature. Eutrophication favours the dominance of some species over others, in fish, benthic zooplankton, phytoplankton and macroalgal communities. Current opinion is that too many niches have been filled by opportunistic and/or invasive species to make it likely that the Black Sea will ever recover to exactly how it was in the 1960s. Inputs are predominantly river loads and atmospheric deposition (nitrogen through air caused by fossil fuel combustion from vehicles and power generation). An appointment exercise for the Danube showed largest contributions from agriculture and sewered and unsewered (urban) settlements. The nutrient loads from coastal point sources (direct municipal and industrial discharges) are a tiny fraction of the load from rivers to the Sea. However, information on monitoring of and compliance with standards for the discharge of nutrients to sewer from industry has not been made available, so it is difficult to estimate the industrial contribution to municipal sewage treatment works effluent.

**Commercially important marine living resources** have been greatly affected by alien species introductions, eutrophication, over-fishing and habitats change/damage. Declining stocks of predatory species such as bonito, horse mackerel and bluefish resulted in an increase in non-predatory species such as anchovy and sprat. Consequently, fishing fleets have increasingly targeted these smaller species, resulting in increased by-catches of larger, less abundant fish species. Annual total fish catch statistics show an improving situation, but these figures are dominated by catches of anchovy and sprat. There have been recent improvements in catches of some other fish (e.g. bonito), but turbot, dogfish and whiting catches have either shown no improvement or have fallen over the past decade-or-so. Sturgeons remain endangered. Unsustainable fishing practices are still in relatively common use. The contribution of illegal fishing activities to damage/change of marine living resources is not clearly understood, but there is a general acceptance that this is a causative factor.

**Pollution** is another key problem in the Black Sea area. Pollution loads data are very incomplete but relatively high contamination levels of some pesticides, heavy metals and PCBs are present at specific sites in the Black Sea, with illegal dumping/discharges (particularly of agrochemicals) being recognized as a particular problem. There is little incentive for pollution prevention and control in the industry sector (lack of enforcement). The historically poor enforcement of discharge standards and a failure to consider the Sea itself as a receiving water body for discharges to river are considered to be the principal reasons underlying the pollution status of the Sea. A huge increase in the volume of oil being transported across the Black Sea and oil/gas extraction from beneath the Sea itself have greatly increased the risk of oil pollution. Remote sensing data show that the majority of oil spills occur along major shipping routes, suggesting that shipping, rather than land-based oil installations have been the principal cause of concern. However, a single large spill from ships, platforms or land-based oil installations could severely impact biota and the economies of all coastal countries.

Between 1996 and 2005 a total of 48 new alien species were recorded, which represents over 22 % of all registered aliens. This increase in **invasive species** suggests a serious impact on the Black Sea native biological diversity, with negative consequences for human activities and economic interests. The failure to adequately treat ship ballast water

is regarded as being an important cause of the problem (shipping). To a lesser extent, aquaculture has also been regarded as a vector for the introduction of invasive species. Pressures on marine biodiversity in the Black Sea arise from all above mentioned activities and problems.

Table 4 : Key impacts, pressures, uses/sectors in the Black Sea

Impact	Pressure	Use / sector	Comments
Nutrient and organic matter enrichment (= eutrophication)	Input of fertilizers Inputs of organic matter	Agriculture and urban waste water through rivers Transport and energy production	River loads and atmospheric deposition are comparable "sources"
Contamination by hazardous substances	Non-synthetic and substances (heavy metals, PCBs, pesticides, oil)	Industry, agrochemicals, shipping	Illegal dumping is important (e.g. many non-EU countries)
Biological disturbance	Introduction of non-indigenous species	Shipping, aquaculture	
Biological disturbance	Selective extraction of species	Commercial fisheries	Overexploitation and by-catches. Additional underlying causes are eutrophication, pollution and invasive species

#### 1.1.2.5

#### The North-East Atlantic

From the recently published QSR (2010), we can derive some of the key pressures with regard to the North East Atlantic (for North Sea, see section 1.1.2.1). It has been assessed that the most widespread impacts on ecosystems result from fishing while the emerging impacts of climate change cause serious concern. While the current status (related to OSPAR Strategy Objectives) and impacts of human activities are different for each of the regions, a number of cross-cutting issues affect the quality status of large parts of the OSPAR area:

- **Fishing:** Excessive fishing pressure is causing widespread problems in parts of the OSPAR area. **Stocks** are being fished at unsustainable levels while by-catch and discards pose severe pressure on different species. The stock of bluefin tuna is a major concern in the wider Atlantic region. In 2007, the annual catch was estimated to be double that allowed by the fishing authorities and well in excess of the level scientists believe to be sustainable. Improved surveillance seems to have reduced catches in 2008, further reductions and actions remain urgent though. Cod and whiting are depleted in the area to the West of Scotland and in the Irish Sea. The anchovy population in the Bay of Biscay declined dramatically due to a lack of young fish. **Damage to seabed habitats** due to benthic trawling is a particular problem in shallow areas of the Celtic Seas. Fishing is one of the main causes for the continuing decline in biodiversity in the whole North-East Atlantic region.
- **Hazardous substances:** Contamination with heavy metals, PAHs and PCBs is widespread in coastal sites in the North-East Atlantic. The pressure is assumed to be less significant than in the North Sea area but further action is needed to prevent discharges and emissions of both well-monitored and less well-known substances.
- **Marine litter:** **Pressure from litter** is particularly relevant for (beaches around) the Irish Sea. Unacceptable quantities of litter are real threats to seabirds, turtles and marine mammals when washed into the sea. It is assumed that much of this litter originates from land-based sources.
- **Human construction activities:** **Pressures** from these activities result **from coastal and offshore engineering activities** and are expected to rise in the future (renewable energy, climate change adaptation, CO<sub>2</sub>-storage, ...). (Improved) coordinated spatial planning is considered to be urgent for most North-East Atlantic regions. Next to direct impacts, these activities (including shipping and mineral extraction) also contribute to levels of noise, litter and introduction of non-indigenous species whose impact and extent are not well understood.

Table 5 : Key impacts, pressures, uses/sectors in the North East Atlantic

Impact	Pressure	Use / sector	Comments
Physical damage	Abrasion	Commercial fisheries	Celtic Seas
Biological disturbance	Selective extraction	Commercial fisheries	Overexploitation and by-catches
Other physical disturbance	Marine litter	Different (mainly land-based) sources	Irish Sea
Contamination by hazardous substances	Synthetic and non-synthetic substances (heavy metals, PAHs, PCBs)	Different sectors	Coastal areas: both emissions and discharges
Physical loss	Sealing / smothering	coastal protection / offshore constructions	Expected to grow in future periods

## 1.2 Database of measures: logic and structure

### 1.2.1 Building blocks

The setup and structure of the database followed from the aspiration to present this inventory as a useful toolkit for policy makers in the different EU Member States. The compilation of identified measures into a user friendly database was done according to a predefined structure and aimed to include all relevant related information.

Besides descriptive and detailed information on the individual measures, the database has been further completed with related data elements regarding e.g. the pressure or GES-descriptors and more precise information on the implementation or the quality of the available information. In brief, the database has been structured along a number of building blocks in order to optimize the quality and the amount of data that can guide Member States in choosing an appropriate set of measures:

- The first component of the presented database consists of the indicative **pressures and impacts** (Annex III of the MSFD-Directive) and sometimes provides additional descriptive information on the pressure and the connection to the measure. Moreover, the database also includes the main **sectors or uses** (sometimes activities) driving or causing the pressure.
- Next, a number of columns are dedicated to the description of **the measures**. These include qualitative and descriptive information on the individual measures and also allocate them to a workable and logical typology. Additionally, the categories of the MSFD aggregate typology of measures (Annex VI of the MSFD-Directive) have also been added to the database. The database creates the opportunity to further detail information on the implementation status and the (geographical) scale of the considered measures.
- The database foresees the option to provide more details on the **data quality** and the **sources of information**. This can be relevant both for internal use (the project) and for future users of the database.
- The structure of the inventory allows to establish the link between the measures and the **Good Ecological Status descriptors** listed in Annex I of the Directive.

These descriptors encompass the objectives that can be targeted with the (set of) measures and are a key element in the database.

- The final part of the inventory is destined to compile **additional information** regarding the (set of) policy measures in order to support the further parts of the study.

### 1.2.2 Workable an searchable tool

In order to develop the database as a searchable and suitable tool for Member States, the use of standard terminology for the data is maximised (e.g. sectors, pressures, typology). If we want to allow easy searches through filters, each “searchable” field in the database must use a fixed and limited set of “values”.

For the fields related to the MSFD (pressures – impact state – GES) this is clear, but during data collection it might occur that additional data fields are required and this (standardizing) logic will be important in order to keep the database manageable.

- **Pressures and impacts:** list of 8 pressure/impact groups provided in Annex III (table 2) of the MSFD. If a measure has impact on several pressures, it will be integrated more than once, however, in most cases one pressure will be predominant.
- **GES:** 11 descriptors from the Directive.
- **Uses/sectors:** Fisheries, Aquaculture/ mariculture, Shipping/ ports, Aggregate extraction, Tourism/ recreation, Renewable energy (wind/ wave, tides), Coastal defense/ flood protection, Military defense, Oil/gas & electricity exploitation, Research, Nature conservation, Other land based industry, Agriculture, General (multiple sector or society in general)
- **Measures**

### 1.2.3

#### Establishing links between measures and MSFD-elements

The interconnection between the presented measures and the Pressures/impacts – GES defined in the MSFD-Directive has served as the guiding principle for the structure of the inventory (see section 1.2.1). During data collection, these relationships were continuously considered and both experts and literature sources contributed to establish the most likely relation between measures and what indicative pressures and impacts listed in Annex III of the MSFD they are addressing. The list of Good Ecological Status descriptors listed in Annex I of the Directive were taken into account as well, as those represent the final objectives of the measures.

The determination of relationships and qualitative description has mainly been based upon literature or expert judgment (see annex 2). It appeared to be more difficult to collect this kind of information from expert interviews, mainly because some interviews could not be taken beyond the strategic level, leaving little opportunity for discussions at the level of specific measures. The drivers for the indicative pressures have also been added to the inventory. It is of note that this exercise cannot succeed in being exhaustive (multiple drivers, difficult to define sectors) though we believe that we made a good start in including the most dominant uses. The interconnection between measures and MSFD-elements has been established in a two-step approach<sup>14</sup>:

- Definition of the link between measures and i) pressures and impacts (as defined by MSFD, Annex III Table 2) and ii) sectors and / or uses:
- Definition of the link between measures and the GES descriptors (as defined by MSFD, Annex I): The assessment from this part of the exercise strongly relied on the integration table presented in annex 3. This integration table is linking state characteristics to pressures through impacts and derived from the draft report on the relationship between initial assessment and criteria for GES (European Commission, DG ENV, draft April 2011)<sup>15</sup>.

## 1.3

### Data collection

The data gathering process has built upon a two-track approach. Literature review served as a starting point to detect relevant sources, organizations and experts. Experts have been contacted to provide their experiences on specific requirements of this study through telephone interviews. 24 experts have been willing to cooperate to the project and participated in semi-structured interviews. The detailed list of contacts can be found in annex 4. Experts have been approached both aiming for a good EU-geographical coverage and different angles or perspectives with regard to the marine environment:

- Regional Seas organizations like HELCOM, Black Sea Commission, Union of the Baltic Cities and national authorities, ...
- Research and knowledge institutes: Stockholm Resilience Centre, CEFAS, ...
- Non-governmental (environmental) Organizations: Black Sea NGO-network
- Marine Park authorities, e.g. Miramare, La Maddalena, ...

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<sup>14</sup> The approach (including some examples) has been further described in annex 1.

<sup>15</sup> European Commission (April 2011, draft report). Relationship between the initial assessment of marine waters and the criteria for good environmental status” by the Marine Environment and Water Industry Unit, DG Environment.

## 1.4 Results of the inventory exercise

The inventory of measures has the format of an Excel database consisting of nearly 140 measures with potential to improve or maintain the marine environment in different EU Member States. The inventory does not pretend to present an exhaustive overview of all measures with potential. Desk research efforts and interviews have been targeted at presenting a broad and diverse range of measures, both implemented or of innovative nature, in order to create a useful tool for Member States in developing their program of measures.

The database integrates information collected during the identification of measures, regarding the measure and its implementation status, the pressure and relation with GES and information on the effects and evaluation of the measure whenever this could be identified from the screening process.

Sections 1.4.1 to 1.4.4 present an **overview of the nature and types of measures collected in the inventory** by using the typology defined for the purposes of this study:

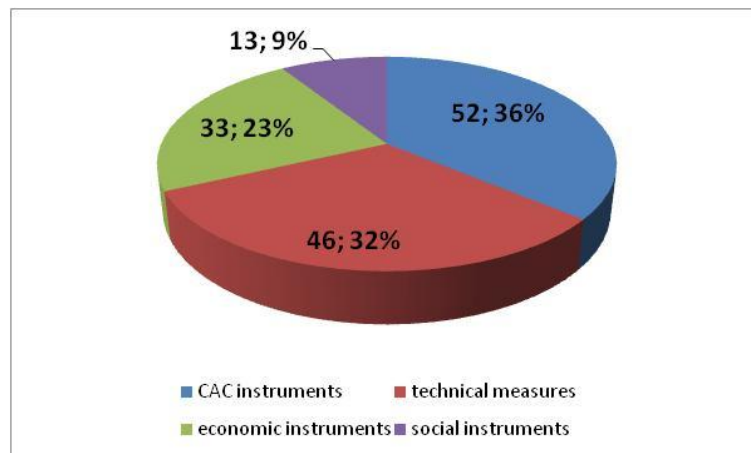


Figure 2 : Number and share of policy measures in the inventory per type of measure

The inventory groups both policy instruments as well as physical measures. The majority of measures are allocated to Command-and-Control instruments (52) and the broad category of technical, technological and research-oriented measures (46). Economic instruments (33) are also well-represented in the inventory. The number of social measures (13) is rather limited.

It is of note that the exercise especially aimed to identify measures at the operational level (clearly the focus of this study), thus ignoring the numerous descriptive initiatives or high level targets that are present in strategic and action plans. The distinction between strategic actions and specific measures has been a continuous difficulty throughout the data collection phase. In this text, specific attention has been dedicated to **Marine Protected Areas (MPAs)** (1.4.1.1) and a first scan of **innovative economic instruments** (1.4.2.1). These innovative instruments are diverse and could play a role in future development of programs of measures within the MSFD but have not been implemented to date. MPA's are considered as an important instrument to maintain or achieve GES as defined by MSFD (see article 13, 4).

#### 1.4.1

#### Command-and-Control (CAC) measures

The bulk of the identified CAC measures can be classified as stricter regulation (including e.g. bans), norms (including licenses and monitoring / control) and regulation of activities in specified zones.

**Bans** can be implemented to address different pressures to the marine environment. A ban can be installed to avoid the introduction of (new) indigenous species from aquaculture or by ballast water discharges. Banning sewage water discharges from passenger and cruise ships in the Baltic Sea<sup>16</sup> is also in progress as one of the steps to cope with the severe local pressure from eutrophication.

In the fisheries sector, bans can be imposed on fishing gear damaging the seabed (beam trawling, towed fishing gear) or it could also be forbidden to discard commercially important species. Discards usually are a consequence of quota being filled or the fish being too small (i.e. *highgrading*, an economic consideration).

RFF (2011) discusses a theoretical analysis of costs and benefits of a total ban or stricter regulation of deepwater drilling.

Another widely installed type of CAC-instruments are **norms and associated control or monitoring systems**. These measures can target different pressures and regulate for example pollution (litter or illegal disposal of waste and fining) or discharges (e.g. controls on discharges of thermal energy or saline discharges from gas storage facilities). Other examples are norms on products (amount of phosphates in detergents, regulation to improve recyclability of products) and/or activities (application of fertilizers in agriculture to limit P per ha, noise limits for shipping, limitation on density of wave and tidal device arrays). License systems are for example applied to fisheries as an attempt to avoid overexploitation (quota systems, restricted fishing regimes). Licenses for aquaculture farms can be granted based upon certain sustainability criteria (e.g. fin-fish farming in Scotland).<sup>17</sup> Such systems are also applied to large construction works in the marine environment (e.g. offshore wind farms), based upon strict Environmental Impact Assessments to minimize the impact on GES. It is of note that licenses or permits can require applicants of permits to consider technical measures or fulfill certain technical conditions, for example detailed location planning (for cables, pipelines) to avoid sensitive areas or drilling locations (directional drilling), with a close connection to spatial control of activities.

**Zoning or spatial control of activities** is also identified as an important regulatory instrument in the marine environment. Examples of measures that are commonly implemented are: no anchor or no mooring zones for ships (protection of rare eelgrass beds, shellfish areas, ...), delineation of aggregate extraction zones, designation of national (no-)fishing zones, protected areas for the generation of fish and shellfish or Marine Protected Areas (MPA). The designation of MPAs usually targets multiple objectives e.g. biodiversity conservation, resource conservation (including fisheries management) and opportunities for recreation.

In order to mitigate impacts of shipping (e.g. in sensitive zones), re-designation of shipping lanes can also be considered as a useful instrument.<sup>18</sup> Designation of zones or

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<sup>16</sup> IMO resolution has been decided October 2010, see e.g. <http://www.enn.com/pollution/article/41866/print>

<sup>17</sup> [www.sepa.org.uk/water/aquaculture](http://www.sepa.org.uk/water/aquaculture)

<sup>18</sup> P.c. CEFAS, Stuart Rogers.

special areas (e.g. biodiversity protection, construction works) can also include a temporal aspect e.g. when considering permanent or real time closures to protect spawning or juvenile fish (Scotland, Norway) or temporal (and spatial) restrictions of certain activities (gas/oil extraction or other aggregate extraction, e.g. seasonal restrictions). A study for EC DG MARE with regard to the establishment of maritime zones in the Mediterranean is currently being executed, covering legal aspects (also with regard to sectors) of zoning and evaluating associated costs and benefits<sup>19</sup>. The study indicates for example some benefits from MPAs and defines cost components related to zoning.

#### 1.4.1.1 Marine Protected Areas as an example of (set of) measures for coastal and marine conservation

MPAs are considered as an important contribution to the achievement of good environmental status under the MSFD (see e.g. article 13, 4). MPAs can be defined as:

*Areas for which protective, conservation, restorative or precautionary measures have been instituted for the purpose of protecting and conserving species, habitats, ecosystems or ecological processes of the marine environment. (OSPAR, 21/07/11)*

According to Alban et al. (2008)<sup>20</sup>, three types of purposes may be assigned to MPAs: (i) biodiversity protection, (ii) sustainable fisheries management, and (iii) the development of non-extractive uses of the ecosystem (ecotourism and other recreational activities). While emphasis of such areas could primarily be the protection of sensitive environments and threatened species, they can also result in increased productivity of fishing areas, regulation and management of different uses of the sea and fostered sustainable tourism and new job-generating activities (Abdulla et al, 2008)<sup>21</sup>

Some authors consider that the task of MPAs is to manage the various uses of marine ecosystems, in order to minimize the impact on the environment as well as use conflicts, especially in multi-use parks. According to this view, MPAs are a tool for integrated coastal and marine management. Literature on MPAs often regards the development of non-extractive uses of the ecosystem (tourism and recreation) as an objective of minor importance. However, in practice, it is often the major reason put forward when creating an MPA, which illustrates the gap between theoretical and real-world considerations concerning MPAs. The state and presence of MPAs in the different regional seas in the EU are briefly described below. In case networks of MPAs are present or being established, the overall size of the protected areas and the objectives of these networks are presented.

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<sup>19</sup> Costs and benefits are assessed from moving to the present legislative and regulatory regime (coastal states have sovereignty over their territorial sea, opposed to High Seas domain) to a situation where all states claim their full EEZ. Study by MRAG in partnership with IDDRA and LAMANS Management Services S.A. A first interim report has been delivered in March 2011.

<sup>20</sup> Alban F., Appéré G. & Boncoeur J., 2008. Economic Analysis of Marine Protected Areas. A Literature Review. EMPAFISH Project, Booklet n° 3. Editum 51 pp.

<sup>21</sup> Abdulla A, et al., (2008), Status of Marine Protected Areas in the Mediterranean Sea. Retrieved from <http://www.medpan.org/upload/1120.pdf>

*Baltic Sea:* in 2008, there were 90 designated Baltic Sea Protected Areas (BSPAs), of which only five have an existing management plan. Roughly 7 % of the Baltic Sea is currently included in the Baltic Sea Protected Areas (Brusendorff et al., 2007). Since the majority of the protected areas are in coastal waters, there is a growing need to designate sites also in countries' Exclusive Economic Zone (EEZ). In order to harmonize the approaches and the implementation processes for marine protected areas (MPAs) in the Northeast Atlantic and the Baltic Sea, HELCOM and OSPAR have jointly developed a detailed work program on MPAs, including a concrete timetable for implementation until 2010. This program was adopted and endorsed by the region's environmental ministers at the joint meeting of both Commissions in Bremen. A preliminary assessment of the BSPA network has shown that it cannot yet be described as an ecologically coherent network (goal set by HELCOM aimed at 2010). According to the preliminary analysis, major gaps in the network are the loss of sites in pelagic waters, poor representativeness of some specific features of the Baltic Sea, and missing management plans (HELCOM, 21/07/2011). The criteria for the designation of an ecologically network of BSPAs include:

- To protect species, natural habitats and nature types in order to conserve biological and genetic diversity;
- To protect ecological processes and to ensure ecological functions;
- To maintain or restore natural habitat types at a favorable conservation status in the natural range of the species of that habitat;
- To protect areas with threatened and or declining species and habitats, and important species and habitats;
- To protect areas of ecological significance;
- To protect areas with high natural biodiversity;
- To protect unique or representative geological or geomorphological structures or processes;
- To protect sensitive areas;
- To protect representative areas;
- To replicate features (having sufficiently many different areas where the same features occur, so that they are not lost if something happens in the other area.

An ecologically coherent network of protected areas should also, via a system of core areas, buffer zones and corridors, ensure ecological connectivity. It should be possible for species to move between protected areas that are located near each other (Brusendorff et al., 2007).

*NE Atlantic and North Sea:* In 2010, the OSPAR Network of MPAs consists of 159 sites collectively covering 147 322 km<sup>2</sup> in the North-East Atlantic. The Greater North Sea and the Celtic Seas are the best represented OSPAR Regions, with 5.46% and 3.53% coverage by OSPAR MPAs respectively. While both the Bay of Biscay and Iberian Coast and the Wider Atlantic have less than 1% protected by OSPAR MPAs. (OSPAR, 2010).

The aims of the OSPAR network of MPAs are:

- to protect, conserve and restore species, habitats and ecological processes which have been adversely affected by human activities;
- to prevent degradation of, and damage to, species, habitats and ecological processes, following the precautionary principle;
- to protect and conserve areas that best represent the range of species, habitats and ecological processes in the maritime area. (OSPAR, 2011)

*Black Sea:* only a small number of MPAs are present in the Black Sea Basin. Romania and the Ukraine have designated a number of sites and conducted a study to extend the current number in Bulgaria and Romania. The Guidelines for the Establishment of Marine Protected Areas in the Black Sea include definitions and actions that need to be taken by regional authorities for a region to be perceived as an MPA. (Goriup, 2008, p. 5). Time horizon for the implementation of these recommendations is thought to be 2012-2015. This publication also notes that the international bodies of countries bordering the Black Sea should a.o. “establish a common platform for monitoring important habitats and species, as well as assess management effectiveness of MPAs and adopt the methodology for establishing a network of MPAs in the Black Sea”. (Goriup, 2008, p.6). A network of MPAs does not exist in this sea basin yet.

*Mediterranean Sea:* the number of MPAs has increased from 40 in the 1990’s up to about 100 in recent days (Revenga & Badalamenti, n.d.). The marine protected and managed area in the Mediterranean cover 97,410 km<sup>2</sup> or approximately 4% of the Mediterranean (Abdulla et al, 2008). In certain areas in Spain, the designation of reserves is leading to observed increases fish stocks, fish sizes and catches in surrounding areas (Revenga & Badalamenti, n.d.)<sup>22</sup>. Protection of marine areas is thus not merely an instrument of nature conservation, but could serve as a useful tool against declining coastal fish resources and a mean to foster coastal tourism and recreation.

Current debate increasingly focuses on the combination of individual MPAs or to establish networks of MPAs. Through interconnections and interdependencies, individual MPAs of this network contribute positively to each other’s integrity by decreasing overall vulnerability (Abdulla et al, 2008). In the Mediterranean the only initiative known working in this direction is MedPan ([www.medpan.org](http://www.medpan.org)), a network of managers of marine protected areas in the Mediterranean<sup>23</sup>. The objective of the network is to improve the effectiveness of marine protected areas management in the Mediterranean.

Some examples of MPAs in the Mediterranean are Cape Roux MPA, Medes Islands and Pelagos Sanctuary. Some of the marine protected areas in the Mediterranean are defined as special marine areas of Mediterranean importance (SPAMI). According to UNEP-WCMC, SPAMIs are sites recognized under the Barcelona convention Protocol to

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<sup>22</sup> Revenga, S. and F. Badalamenti. (n.d.). Management of marine Protected Areas for fisheries in the Mediterranean. Article in *Options Méditerranées*, Series B, no. 62. P. 107-111.

<sup>23</sup> The MedPAN network today counts over 27 members, mainly managers of marine protected areas from the entire Mediterranean basin (including Medes Islands Marine Reserve), and 16 partners that are keen to contribute to the strengthening of the network. These partners manage more than 30 marine protected areas and are working towards the creation of several new sites. A legally independent structure since the end of 2008, MedPAN has recently staffed its permanent secretariat and established it in Hyères, France.

conserve a.o. “the components of biological diversity in the Mediterranean, ecosystems specific to the Mediterranean area or the habitats of endangered species and are of special interest at the scientific, aesthetic, cultural or educational levels”. A summary list of SPAMI has been included as annex to the report (annex 6).

#### 1.4.2

#### Economic measures

The presented inventory distinguishes between fee-based systems, subsidies, liability and compensation regimes and trading systems.

Table 6 : Overview of the number of measures in the Economic instruments category

Economic instruments	# measures
Fee-based measures	15
Liability, insurance and compensation regimes	3
Subsidies	11
Trading systems	4

Economic instruments that are most frequently implemented are fee-based systems (15) and subsidies (11). These instruments are well known and might be more feasible to install or control.

**Fee-based systems** include for example plastic bag taxes (e.g. Ireland), product charges or deposit-refund schemes (bottles) which directly reduce the amount of litter produced. The systems include on the other hand e.g. tourist charges, ship berthing or port reception fees able to generate resources to support e.g. prevention or waste management. Fee systems to generate resources are also applied in the context of MPAs in the form of user fees or fees for underwater tourism. In the case of the Medes Islands MPA for example, the fee contributes 50% of the annual budget of the reserve.<sup>24</sup> Fees, charges or taxes are also commonly implemented to address the pressures from sea-based activities. The UK installed an Aggregates Levy which explicitly covers marine aggregates extraction. Several economic instruments are installed or studied to mitigate the impacts from shipping (emissions, waste, oil pollution). Norway has a NOx-tax in combination with a NOx-Fund (managed through a business organization) supporting investments in NOx-abatement technologies. Other countries implemented or consider charges (or reductions of charges) for (cleaner) ships. Harbour taxes can be differentiated by ship type. Sweden’s differentiated fairway dues give reductions if ships are certified.<sup>25</sup> Such a differentiation can be based upon some kind of defined *clean shipping index*.<sup>26</sup> Finland implemented an oil damage levy based on the amount of oil shipped.

**Subsidies** are implemented to provide incentives to actions or efforts that would otherwise not be executed or postponed. They are often easy to implement as the (political) acceptance is high. They can involve significant use of government finance and their success relies on the behavior of the target group. Another risk of subsidies is that

<sup>24</sup> P.c. Álex Lorente, Marine technical Officer in the Medes Islands MPA.

<sup>25</sup> OECD (2011), Environmental impacts of international shipping: the role of ports, OECD publishing.

<sup>26</sup> Projects running or undertaken e.g. Green award in several ports. Ibid.

they may turn out to be environmentally harmful e.g. if subsidies for fishing gear lead to increased fishing effort and depleted stocks.

Agri-environmental schemes can be considered as an example where farmers need incentives to dedicate a part of their farmland to a.o. the creation of wetlands or buffer strips. These schemes are widely implemented across Europe<sup>27</sup> under the Water Framework Directive and can contribute e.g. to the reduction of eutrophication from agriculture.

This equally applies to support systems for technological solutions (installation of emission abatement technologies or waste management systems onboard ships) or funding to reduce fishing efforts and move towards more sustainable fisheries: allocation of regional funds to promote fishing tourism and small-scale fisheries and decommissioning programs to reduce surplus capacity in fishing fleets.

Other subsidies can lower the cost of certain services e.g. to lower or remove the economic incentive for ships to dump their waste at sea. An example of such a scheme is the “no special fee system” in Baltic ports where ships are not charged directly for using reception facilities for waste<sup>28</sup>. Sweden also implemented grants for disposal of oil waste from ships but with limited effects.<sup>29</sup>

Another objective of subsidies can be to encourage technology development or research for specific problems. This is for example the case for a WWF initiative (international competition) to identify (selective/smart) gear solutions for fisheries.<sup>30</sup> Some of these innovations have already been put into practice. The development of environmentally friendly (aggregate) extraction techniques or seabed restoration techniques could for example be supported by resources generated by aggregate taxes or levies.<sup>31</sup>

The other types of economic instruments are less implemented in the marine strategies. Examples of **liability and compensation regimes** are habitat or species banking (offset schemes e.g. for fish habitats) or a liability scheme for marine pollution. Habitat or species banking did not really find its way in Europe and Member States policy to date, but is implemented in Australia and US (wetlands) and some initiatives in EU (Germany, Sweden, UK).<sup>32</sup> Liability scheme for pollution could be linked to the cost of cleanup but is difficult to enforce and requires a legal context difficult to imply at sea (Ten Brink et al, 2009). Wilcox et al (2007) proposes an innovative combination of a fisheries by catch levy (e.g. for seabirds) with revenue recycling for the eradication of invasive mammals at

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<sup>27</sup> See e.g. Dworak T.; Berglund, M.; Grandmougin, B.; Mattheiss, V.; Holen, S.; 2009. International review on payment schemes for wet buffer strips and other types of wet zones along privately owned land. Study for RWS-Waterdienst. Ecologic Institute, Berlin/Wien.

<sup>28</sup> HELCOM, 2010. Maritime Activities in the Baltic Sea – An integrated thematic assessment on maritime activities and response to pollution at sea in the Baltic Sea Region. Balt. Sea Environ. Proc. No. 123

<sup>29</sup> Naturvårdsverket (2007). Economic Instruments in Environmental Policy - A report by the Swedish Environmental Protection Agency and the Swedish Energy Agency

<sup>30</sup> [http://www.smartgear.org/about\\_smartgear/smartgear\\_pressroom/?199449/2011-WWF-competition-to-net-best-hook-line-and-sinker-announced](http://www.smartgear.org/about_smartgear/smartgear_pressroom/?199449/2011-WWF-competition-to-net-best-hook-line-and-sinker-announced)

<sup>31</sup> E.g. Marine Aggregate Sustainability Levy Fund (MASLF) in the UK. The system also has been put in place in Belgium since 1976.

<sup>32</sup> See Madsen, B., Carroll, N., Moore Brands, K. (2010). State of biodiversity markets report: offset and compensation programs worldwide and Eftec (2010). The use of market-based instruments for biodiversity protection - the case of habitat banking - Technical report

certain specific locations. The compensation is to safeguard breeding spots for these seabirds at specific locations and protect them from invasive mammals.

The screening process identifies four **trading systems** of which two have been implemented to the marine context. Individually transferable Quota (ITQs) have a long history in fisheries (the case of Iceland) and the design of the system is key to the success of such systems. In Denmark<sup>33</sup>, the concept of ITQ has more widely been introduced with large attention for design of the system. Each vessel is allocated a share of the total quota corresponding to the historical catch of the vessel. These shares of quota for vessels may be traded between the fishermen and trade can be facilitated by installed institutions.

Another instrument is a system of voluntary competitive biddings<sup>34</sup>, that could be used to minimize or reduce nutrient loads from farmland. Based on the bids, the authorities pay to the farmer according to the environmental advantage resulting from the measure. This could also be considered as a subsidy scheme where allocation of support depends on the environmental gains that can be realized. Support under the NOx-Fund in Norway (see earlier as this is related to the fee-based system of the NOx-tax) depends on the cost-effectiveness of the proposed emission abatement measures.<sup>35</sup>

Credit-based trading schemes are and have also been considered for e.g. shipping emissions or nutrient emissions from multiple sectors. The feasibility of these schemes has however not been demonstrated so far. For the Baltic Sea where eutrophication is a severe problem, large efforts have been spent to find cost-effective strategies to reduce nutrient inputs. One proposal has been to establish a nutrient emission trading scheme.<sup>36</sup> A study specifically focusing on the feasibility of an EU-wide ETS for both SO<sub>2</sub> and NOx emissions from maritime shipping<sup>37</sup> concluded that it is not legally possible to deviate from or offset the MARPOL Annex VI requirements (applicable to individual ships) through an EU Emissions Trading System (ETS) unless such a possibility was created within the IMO framework. The study also concluded that, under the assumptions that individual ships comply with MARPOL Annex VI and that there would be the possibility to trade with land-based emission sources, there was limited scope for SO<sub>2</sub> trading. As no IMO agreement currently exists allowing for environmental objectives set at international level to be met by an emissions trading scheme, this option has been discarded (Campling et al., 2010 quoted in the EC staff working Paper: Impact Assessment accompanying the

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<sup>33</sup> The Danish Ministry of Food, Agriculture and Fisheries. Implementation of more selective and sustainable fisheries (IMPSEL, 2007)

<sup>34</sup> See <http://www.environment.fi/default.asp?contentid=275727&lan=en>. The measure has not been implemented yet but could be considered where agricultural pressure is high (e.g. Baltic). No further specific information has been identified on the instrument or potential for implementation.

<sup>35</sup> Naeringslevit NOx-fond (2010). Application for Support to NOx-reducing Measures

<sup>36</sup> See e.g. The Swedish Environmental Protection Agency (2009). Proposal for a Permit Fee System for Nitrogen and Phosphorus or Elofsson, K. (2010). Baltic-wide and Swedish Nutrient Reduction Targets. An Evaluation of Cost-effective Strategies

<sup>37</sup> Campling, P., Van Den Bossche, K., Duerinck, J., Deutsch, F., Veldeman, N., Janssen, S., Janssens, L., Lodewijks, P., Vanherle, K., Van Zeebroeck, B., Pallemaerts, M., Van Hyfte, A. (2010). Market-based instruments for reducing air pollution - assessment of policy options to reduce air pollution from shipping, Final Report for the European Commission's DG Environment, June 2010, study by VITO i.c.w. TML, IEEP and ARCADIS Belgium

document “Proposal for a Directive of the European Parliament and of the Council amending Directive 1999/32/EC as regards the sulphur content of marine fuels”, July 15 2011).

#### 1.4.2.1 Side-step on innovative (economic) instruments and measures not (yet) applied in the marine domain

There are a number of innovative (economic) instruments and measures with potential to support the meeting of GES standards in EU marine waters, which either do not yet exist or which exist in other contexts.

##### *Habitat banking*

Eftec et al (2010) discuss the potential use of habitat banking in Europe. In terms of the marine context, they highlight the impact of oil and gas rigs and pipelines, suggesting that the potential for mitigation is high (meaning the potential to offset damage through investment in remediation of other benthic areas). Particularly sensitive areas can be avoided. They also note that the geographical area over which habitats could be traded may need to consider similar ecosystem characteristics for habitat banking to be more efficient – giving the example of inter-tidal saltmarsh in the Netherlands and Eastern England.

Wetland banking has been used in the US case. In the UK, Eftec et al (2010) cite several cases of compensatory actions that may give interesting lessons. Associated British Ports have been involved in several cases including:

- Alkborough – where ABP gave the Environment Agency 25ha of land in return for obtaining 25ha of compensatory habitat – “banking” for actions that may arise at a nearby port. The factor aiding this is the distance between credit and compensation sites.
- Wallasea Island – where compensatory action by Defra has been undertaken and where ABP were interested in buying compensation. This however met with the barrier of finding a suitable transfer location for the credit. This shows the difficulty of moving credits over geographic space: with different environmental characteristics around the coasts it may not be possible to identify credit sites, even if compensation options are plentiful.

The Eftec study suggests that conditions for habitat banking, independent regulation and effective enforcement for biodiversity conservation are not effectively established within the EU. However, the capacity to undertake/implement them is present, and so they could be developed relatively easily (following the appropriate policy decisions).

In the marine context, the controls needed would be similar to Marine Protected Areas. The difficulty of comparability of sites may be more acute in the marine context – where coastal morphology and a range of other factors play a role in habitat creation (e.g. different water mixing, salinity, clarity of water).

##### *Carbon credits*

The carbon capture of seagrasses, coral and other habitats is gaining increasing attention. The concept of “blue carbon” has emerged – with a recent study suggesting that improved management of the oceans could lead to savings of an annual loss of

450Tg C per year, compared to REDD based green carbon management of 555 Tg C per year (Trumper et al, 2009 cited in Nellemann et al, 2009). Preliminary economic analysis by Ullmann (2010) suggests that the value of seagrass, estuarine and oceanic mangroves may be comparable on per hectare basis with that of tropical forests, though opportunity costs may be greater. Difficulties in applying a REDD+ type agreement to mangroves and other sea grasses may include the issue that REDD focuses on above soil carbon sequestration (Nicholas Institute, 2010), which if applied to the marine context would significantly reduce the carbon gain (because seagrass stores large proportions of carbon in sediments).

Blue carbon has not attracted significant investment in terms of the Clean Development Mechanism, and faces the difficulty of permanence as measures are considered temporary (Thomas et al, 2010). The general lack of consideration of blue carbon overlaps with the need to enhance the adaptive capacity of the oceans. Much more research is needed on this issue before credits could be given for carbon in the marine environment.

*“Mari-environment” schemes*

There has been much debate over whether agri-environment schemes have been effective in meeting biodiversity goals, however lessons could be learnt from agri-environment schemes in the European context. “Mari-environment” schemes could include a number of policies to influence the management of the marine environment. These may include direct payments to marine users (e.g. aquaculture, fisheries) to help preserve biodiversity, which are more complex to implement in the marine context because of difficulties of conflicting sectoral uses of stretches of water, a lack of property rights and difficulties with enforcement.

Agri-environment schemes (AES) can be applied broadly to large areas or be specifically targeted. In the EU, AES are defined at Member State level and can be grouped into objectives for reduction of environmental risks associated with agricultural practices and preservation of landscapes (Kristensen and Primdahl, 2006)<sup>38</sup>. The following table identifies a number of measures in the AES case and presents potential “mari-environment” measures that could draw lessons from the terrestrial equivalents.

Table 7 : Identification of measures in agri-environment schemes and their marine equivalent

<b>Agri-environment scheme measure</b>	<b>Marine equivalent</b>
<i>Productive land management</i>	<i>Productive marine management</i>
Input reduction – e.g. fertilisers, pesticides	Input reduction – e.g. nutrients
Organic farming	Organic fish farming
Extensification of livestock	Extensification of fish farming
Conversion of arable land to grassland and crop rotation	Rotation of zoning of areas used for different activities

<sup>38</sup> Kristensen, L, and J. Primdahl (2006) “The Relationship between Cross Compliance and Agri-environment Schemes” Deliverable 13 of the Cross Compliance Network. Available online at: <http://www.ieeplondon.org.uk/publications/pdfs/crosscompliance/D13%20Cross%20compliance%20and%20agri-environment%20schemes.pdf>.

<b>Agri-environment scheme measure</b>	<b>Marine equivalent</b>
Undersowing and cover strips (buffer strips) and prevention of erosion and fire	Zoning and prevention of oil spills and chemical contamination
Actions in areas of specific biodiversity/nature interest	Actions in areas of specific biodiversity/nature interest
Genetic diversity	Genetic diversity – e.g. separation of farmed and wild fish
Maintenance of existing sustainable and extensive systems	Maintenance of existing sustainable and extensive systems
Maintenance of farmed landscape	Maintenance of non-natural seascapes – e.g. aquaculture farms
Water use reduction	Reduction in oxygen demands
<i>Non-productive land management</i>	<i>Non-productive land management</i>
Set aside	Set aside
Upkeep of abandoned farmland and woodland	Upkeep of sea defenses and coastal lagoons
Maintenance of the countryside and landscape features	Maintenance of the benthic environment and water column
Public access	Public access

Source: AES description based on Kristensen and Primdahl (2006), own ideas for mari-environment equivalents

Other lessons can be drawn in terms of cross compliance and agri-environment schemes. Under agri-environment schemes, payments can also be linked to compliance with e.g. controls on livestock density or pesticide use. Such linkage can help facilitate improved environments – and could be applied in the marine case.

#### *Underwater noise*

An emerging issue is that of underwater noise pollution, This has been shown to have impacts on wildlife. In terms of options for noise control, Andre et al (2009) discuss a number of measures that could be used, notably:

- Construction of quieter oceangoing vessels;
- Adequate maintenance of ships;
- “Skysail” deployment;
- Route modification;
- Navigation speed regulation;
- Technological solutions including bubble screens.

Policy measures could be applied in a number of ways, e.g. technological standards on ship construction could be established. However, this needs international action as

shipping markets are more diffuse than e.g. the car fleet where standards can be more easily set.

Economic instruments could be used to incentivize the use of quieter ships. Measures could include differential harbor fees or registration fees for ships with certain technologies or with certain levels of noise. Such fees would require international cooperation to prevent the equivalent of pollution havens – with noisy ships using ports without strict regulation potentially causing more damage as a result.

Route modification could be adopted through charging on shipping lanes. An example of a charging system for shipping lanes is the Panama canal, where ships pay a toll or a premium on top of the toll to transit faster. This case is easier in the case of a narrow, easily controlled water way, but with further advances in satellite technology similar methods may be possible to control access to sensitive areas.

#### *Reform of Environmentally Harmful Subsidies (EHS)*

Environmentally harmful subsidies (EHS) have attracted much attention in recent years within the OECD, but largely outside the marine context. Definitions include: “All other things being equal, the [environmentally harmful] subsidy increases the levels of output/use of a natural resource and therefore increases the level of waste, pollution and natural exploitation to those connected” (Valsecchi et al, 2009, after OECD, 2005). Examples could include tax exemption for shipping and some subsidies for fisheries. For fisheries, the issue of EHS has attracted some attention in recent years, though with limited impact on policy. The TEEB highlights this:

*“despite considerable overcapacity in the fishing industry, governments continue to subsidise the sector. This encourages further fishing effort which contributes to the decline in global stocks.” (Lehmann and Ten Brink, 2011)*

In Europe, there is some evidence that subsidies leading to modern fleets have increased pressure on certain stocks – including Southern hake and monkfish – and hindered recovery of certain overfished stocks (Poseidon, 2010).

The impact assessment of the reform of the Common Fisheries Policy considered some subsidy reform – with options considered including the gradual move away from “bad” subsidies to “good” subsidies. The targeting of subsidies on “smart green issues” under all scenarios considered, the intention was to reduce EHS (Agnew et al, 2010). This has led to the integration of the removal of EHS into the proposals for the reform of the CFP.

### 1.4.3

#### **Technical, technological or research-oriented measures**

The inventory provides a variety of technical measures ranging from research oriented initiatives to clean-up actions at beaches. The identified measures cannot be considered exhaustive but provide a good starting point to see what has already been done to address the different pressures in the EU regional seas.

The identified technical measures are rather equally distributed over the impact and pressure categories defined in the MSFD and the inventory collects nearly 50 measures. These measures are generally mitigation and remediation tools or improve traceability of marine pollution or act as spatial or temporal distribution control (Annex VI of MSFD).

Measures to mitigate pressures on the seabed (*Physical damage* - abrasion and selective extraction) are mainly addressing impacts of aggregate extraction activities (5). These concern technical and research oriented measures to mitigate the effects of extraction (environmental friendly extraction technologies) or after care remediation of extraction activities. Monitoring of impacts on habitats and species and post-operational monitoring are also included, as these activities can determine whether additional measures are required.<sup>39</sup> The seabed can also be severely affected by trawling activities in fisheries and recreational activities (anchoring and mooring in sensitive areas). It is of note that specific individual technical solutions mitigating impact of seabed damaging gear are not considered in the inventory<sup>40</sup>.

Measures addressing smothering and sealing (*physical loss*) are considered to target renewable energy sectors and oil/gas and electricity exploitation (often cable or piping systems). Identified technical measures include post-operational monitoring. It is of note that detailed location planning can be considered as an important measure to mitigate the impact of these activities, though planning instruments are allocated to Command-and-Control instruments as specific (planning) requirements are often included in environmental permitting / licensing procedures (see paragraph 1.4.1).

Nearly all measures targeting the pressure related to noise (*other physical disturbance*) are technical or research oriented measures. Examples are seismic surveys to guide operations or mitigating measures (e.g. ramp-up procedure) during construction and other noisy activities. Drivers of the pressure are then often construction or exploitation activities for gas / oil extraction, aggregate extraction or renewable energy (wind farms).

Several measures were identified to address the pressure from marine litter caused by several sectors. Measures for lost and abandoned fishing gear could be either preventative (retrieval, gear marking) or curative (cleanup actions), or otherwise mitigate (biodegradable netting, improved sound reflectivity to minimize ghost fishing<sup>41</sup>) the detrimental effects of "orphan" fishing gear. The negative impact of shipping waste in general can be minimized by improving port reception facilities for (all types of) waste.

Only one technical measure has been identified regarding pressures related to disturbance or alteration of hydrological processes (thermal or salinity regimes). Research in the UK<sup>42</sup> suggests that managed realignment<sup>43</sup> in coastal areas can provide benefits for coastal protection and the environment. It is of note that these results can't be transferred to other situations and a case-by-case analysis is advised. Increased

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<sup>39</sup> DEFRA. (2007). Cost Impact of Marine Biodiversity Policies on Business - The Marine Bill. Final Report.

<sup>40</sup> Policy instruments (ban or regulation or designation of specific zones) that steer these solutions are.

<sup>41</sup> Abandoned, lost or otherwise discarded fishing gear (ALDFG) is of increasing concern due to its numerous negative impacts. The ability of ALDFG to continue to fish (often referred to as "**ghost fishing**") has detrimental impacts on fish stocks and potential impacts on endangered species and benthic environments. ALDFG is also a concern because of its potential to become a navigational hazard (with associated safety issues) in coastal and offshore areas. (Macfadyen et al., 2009)

<sup>42</sup> Luisetti, T., Turner, R. K., Bateman I. J., et al. (2011) Coastal and marine ecosystem services valuation for policy and management: Managed realignment case studies in England. *Ocean & Coastal Management*. 54: 212-224.

<sup>43</sup> Managed realignment is an important soft engineering coastal defense technique which aims to achieve sustainable flood defense by recreating eroded saltmarsh and mudflat habitat. This is done by creating new defenses further inland and allowing the existing defense line to breach and the land to be tidally inundated. See e.g. <http://www.hull.ac.uk/coastalobs/general/erosionandflooding/managedrealignment.html>

environmental control and monitoring for large scale projects and well-defined requirements for contractors of large projects could also be considered as technical measures. Examples were identified in the frame of the Oresund link between Denmark and Sweden and the environmental management in this huge project has been positively evaluated<sup>44</sup>. It is of note that these have been included in the inventory as command-and-control instruments as the requirements have followed from a cooperation between Danish and Swedish authorities.

Several measures were identified to reduce the impact of contamination (or input of) by *hazardous substances*. These measures relate to different sectors. Shipping and port areas (oil but also other contaminants) are seen as key drivers and measures are diverse: examples are green bunkering (i.e. a number of safety measures to reduce the risk of accidental spills)<sup>45</sup>, non-hazardous anti-fouling paints, surveillance systems for oil spills at sea or contingency plans for chemicals and oil spills in case of accidents. Measures towards other polluting sectors are for example monitoring and mitigation of impacts (e.g. decommissioning stage of oil / gas extraction activities) or technological remediation measures like solidification of contaminated sediments<sup>46</sup> (dredging operations in harbours).

*Systematic and/or intentional releases of substances* have primarily been related to the shipping air emissions contributing to e.g. acidification, assuming that emissions from land-based point sources and transport are subject to other policies. Most of the identified measures are economic or CAC-instruments. Technical measures could contribute e.g. when considering the option of shore side electricity facilities in harbors (reduce emissions while at berth) or the installation of hard substrate for algae and shellfish as a natural filter. The latter measure is studied in a pilot project in the port of Rotterdam to improve the biodiversity in the water and the overall water quality in the harbor. Organisms like algae and shellfish are expected to improve the water quality in the harbor thanks to their water filtering capabilities (OECD, 2011). Shore side electricity facilities<sup>47</sup> can help to lower emissions from ships at berth and associated impacts like acidification. While in port, ships use their auxiliary engines to produce electricity for hotelling, unloading and loading activities. While at berth, electricity can be provided to ships from the national grid (and thus other power suppliers). These suppliers are likely to have lower emission factors per MWh of electricity, either due to the type of electricity production process (e.g. wind, hydro, nuclear etc) or the stringent emission controls imposed on land based power plants (e.g. through the European Union's Integrated Pollution Prevention and Control Directive and the Large Combustion Plant Directive). The bulk of the identified measures addressing *eutrophication* are based on implementations or research in the Baltic region. The data collection process has clearly demonstrated that eutrophication is especially relevant for the Baltic Sea area. It is a major environmental concern both because of the specific characteristics of the area / sea and the problem of eutrophication *in se*. There appear to be multiple (also innovative)

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<sup>44</sup> Gray, J. (2005). Minimizing Environmental Impacts of a Major Construction: The Øresund Link. Article published in Integrated Environmental Assessment and Management — Volume 2, Number 2—pp. 196–199

<sup>45</sup> Concept launched by the ports of Gothenburg and Stockholm. See for example OECD (2011), Environmental impacts of international shipping: the role of ports, OECD publishing.

<sup>46</sup> Project SMOCS Brochure, Sustainable Management of Contaminated Sediments in the Baltic Sea. Field test in Port of Gävle, Sweden, in October 2010. Larger scale application planned 2011-2012

<sup>47</sup> See for example Entec (2005). Service contract on ship emissions : Assignment, abatement and marked-based instruments. Task 2A: Shore side electricity. Final Report. Report for European Commission, DG ENV.

measures that aim to reduce the problem, taking into account that a lot of measures are already implemented: bioremediation through means of mussel farming or releasing predatory fish to restore food webs, training/certification for spreading and transporting manure, anaerobic digestion or separation technologies for manure and ditch dams or filters to reduce run-off from farmland. With regard to the shipping sector, measures mainly concern port reception facilities for sewage water. In some areas where urban waste water capacity and performance (overflows) in coastal areas is not sufficient, measures should address this driver as well. This need has been identified in the Black Sea region<sup>48</sup>.

Identified technical measures targeting the impact category *biological disturbance* distinguish between the introduction of pathogens / non-indigenous species and selective extraction (including overexploitation by fisheries). Measures against invasive species usually target shipping as the main vector for translocations through ballast water (treatment technologies) and hull fouling (development of anti-fouling, free of hazardous substances, vessel inspections and hull cleaning). Migration barriers could be installed to prevent the invasion of species through for example large canals (Suez-Canal), though insufficient evidence could be found on projects or expected results. Intensive fishing activities could be better controlled by developing remote sensing (satellite) system for observing and controlling fishing operations in open sea. Fish stock could also benefit from the further development of more selective gear technical solutions retaining the intended catch and separating or avoiding the unintended catch.

#### 1.4.4

#### Social measures

The majority of the identified social measures are awareness raising initiatives and/or the introduction and acknowledgement of “sustainable” products. These products can take different forms and help to address several pressures or sector-related problems: eco-labels for fishery products, index for clean ships which can help ship-owners to steer purchase decisions, the development of ecotourism in Natura 2000 areas, awards for “clean” coastal villages or certification for clean marinas in France<sup>49</sup>. These instruments are sometimes also considered as economic measures, if the product differentiation results in e.g. mark-up on prices (eco-label). Coastal villages can equally benefit from increased attractiveness for tourists due to better waste management but the award is considered as a social instrument as it follows from voluntary actions of the target group. Awareness raising can also occur through mere communication of research results (nature protection, dolphins in sensitive areas) or explicit stakeholder involvement (fishing for litter, agricultural forum to address the eutrophication problem in the Baltic).

For some marine problems it is argued that social measures could by far be the most effective measures through means of prevention. This is for example the case for the prevention of introduction or transfer of invasive species or the attention to the problem of “ghost fishing” as a consequence of lost and abandoned fishing gear<sup>50</sup>. Curative

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<sup>48</sup> The Implementation of the Black Sea Strategic Action Plan - A Bulgarian Perspective: BSC, (2005), The Implementation of the Black Sea Strategic Action Plan – A Bulgarian Perspective. See [http://www.blackseacommission.org/\\_publ-Newsletter08-EN-04.asp](http://www.blackseacommission.org/_publ-Newsletter08-EN-04.asp)

<sup>49</sup> <http://www.ports-propres.org/historique-ports-propres.php>

<sup>50</sup> Macfadyen, G.; Huntington, T.; Cappell, R. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies, No. 185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.

measures to address these problems are often very costly (clean-up) or effectiveness is uncertain (eradication of invasive species, treatment of ballast-water).

## 1.5 **Summary assessment of coverage**

Paragraph 1.3 has attempted to provide a summary of the inventory of measures that has been compiled from the comprehensive data collection process. Considering the large amount of measures and related information, it is not feasible to comment on the details of all identified measures. For further details, we refer to the separate database file.

Below, we present a brief comparison between the measures identified and the internal objectives described in section 1.1.2, i.e. the scoping exercise for the different regional seas. We have summarized the coverage of the inventory of measures by matching the number of measures with the different combinations of pressures and drivers.

Table 8 : Number of identified measures per pressure & use / sector combination

Pressures	Sectors / Uses	# of measures
Selective extraction species	Fisheries	18
	Nature conservation	7
	General (multiple sectors or society in general)	2
	Aggregate extraction	1
	Tourism/ recreation	1
Input of fertilizer/ organic matter	Shipping/ ports	1
	Agriculture	11
	Shipping/ ports	5
Marine litter	General (multiple sectors or society in general)	4
	Aquaculture/ mariculture	4
	Fisheries	1
	General (multiple sectors or society in general)	7
	Shipping/ ports	6
Siltation/abrasion/selective extraction	Fisheries	5
	Tourism/ recreation	2
	Other land based industry	2
	Oil/gas & electricity exploitation	2
	Aggregate extraction	11
	Tourism/ recreation	3
	Coastal defence/ flood protection	1
Intro heavy metals/ POPs/ oil	Oil/gas & electricity exploitation	1
	General (multiple sectors or society in general)	1
	Fisheries	1
	Shipping/ ports	10
	General (multiple sectors or society in general)	3
Intro other substances	Oil/gas & electricity exploitation	3
	Aggregate extraction	1
	Other land based industry	1
	Shipping/ ports	12
Intro pathogens/ invasive species	General (multiple sectors or society in general)	3
	Aquaculture/ mariculture	1
	Other land based industry	1
	Shipping/ ports	9
Noise	Aquaculture/ mariculture	3
	Nature conservation	1
	Oil/gas & electricity exploitation	4
	Shipping/ ports	3
	Renewable energy (wind/ wave, tides)	2
Smothering/ sealing/ erosion	Aggregate extraction	1
	Renewable energy (wind/ wave, tides)	3
	Oil/gas & electricity exploitation	3
	General (multiple sectors or society in general)	1
Changes in thermal regime/ salintiy regime	General (multiple sectors or society in general)	3
	Coastal defence/ flood protection	1
	Renewable energy (wind/ wave, tides)	1
	Other land based industry	1

One of the most common pressures identified for all EU seas is the selective extraction of species. **Fishery activities** put constant pressure on fish stocks, due to overfishing (unsustainable quantities), discards or high grading and unintended by-catches. The inventory presents different measures to address these problems. Fisheries are causing a second important problem in some areas due to the application of destructive techniques (seabed, trawling operations). This has also been addressed in the inventory. **Eutrophication** has also been considered as a general threat for EU seas, especially for the Baltic Sea. For some seas the problem is more limited to the coastal areas (Mediterranean, North Sea). One major contributing sector is agriculture. From Table 8 it can be read that 11 measures in the inventory address this pressure from agriculture. It is of note that most of the identified measures originate from the Baltic where the problem is a large environmental concern. Land-based sources and shipping can also contribute to the problem through emissions to air and sewage discharges. The inventory covers these drivers, though it is of note that emissions to air from land-based sources are assumed to be predominantly targeted by other policy areas.

For pollution and contamination with **hazardous substances**, multiple measures could be identified. Table 8 however shows that the main considered sector is shipping and ports. This is definitely due to their relevance for both acidification (emissions) and oil pollution. On the other hand, identified measures to address pollution from land-based sources were limited to improved enforcement (some EU regions) and improved capacity for waste and waste water treatment facilities. Some (pilot) measures have been identified to mitigate/remediate e.g. polluted sediments in harbors.

**Marine litter** seems to be particularly relevant for the North Sea, North East Atlantic and the Mediterranean Sea. The inventory shows a significant number of possible measures of different nature, both for land-based and sea-based sources (e.g. fishing gear, ships waste).

For the Mediterranean Sea and the Black Sea, the **introduction of non-indigenous species** is also considered as a key pressure. The inventory lists some potential measures, though it is of note to mention that prevention can be regarded as the most effective measure. Moreover, already in 2004, the Convention for Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted by IMO. The entry into force of this Convention could be an important step in tackling this problem, but a minimum number of members (Parties) need to ratify.<sup>51</sup>

For the North Sea area, **aggregate extraction** operations have been considered as a key pressure. The inventory lists a number of spatial restrictions and a limited number of mitigating measures.

From this exercise, we can conclude that the main pressures identified in the different EU regional seas (section 1.1.2) have already been covered by measures in the inventory.

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<sup>51</sup> This convention is not yet in force, as not enough countries have ratified it to date. Several individual countries are nevertheless moving ahead with measures to address the adverse environmental effects of ballast water as the impacts are locally often very significant (OECD, 2011).

## 1.6

### Inventory as a dynamic and growing supporting tool

The inventory can be regarded as an inspirational source for Member States in preparing their program of measures to achieve or maintain good environmental status of their marine environments.

*Support tool* - The structure of the inventory allows for Member States to search the database for measures addressing specific pressures or target specific sectors. The database is organized to enable installing filters on all fields of the database.

E.g. when selecting the measures that address the marine litter problem related to shipping/ports activities, this results in a set of 6 different measures (economic, social and technical measures). The table below is a screenshot of some columns in the database.

Table 9 : Extract from database

Pressures - detailed per impact class	Users (sectors) (WG ESA 2010)	Typology of measures (own typology - high level)	Typology of measures (own typology - detailed)	Measure
Marine litter	Shipping/ports	Economic measures	Fee-based measures	'no-special-fee' system in all Baltic Sea ports
Marine litter	Shipping/ports	Social measures		Certification system for ports and marinas
Marine litter	Shipping/ports	Social measures		Clean Shipping Index
Marine litter	Shipping/ports	Economic measures	Fee-based measures	Commercial and recreational fishing fees. Ship berthing fees Port reception fees
Marine litter	Shipping/ports	Economic measures	Subsidies	Financial and technical support for the installation of waste management systems on board of ships
Marine litter	Shipping/ports	Technical, technological and research-oriented measures		Installation of Port Reception Facilities

The database equally includes information on the relation between the measure and the 11 defined GES-descriptors in the MSFD. All these measures contribute to qualitative descriptor 10 "Properties and quantities of marine litter" but some measures can equally impact other GES descriptors which is indicated in the database (e.g. 'clean shipping index' including different environmental parameters regarding oil waste, sewage water treatment, ...). The relation between measures-pressures and GES is not always straightforward. The data fields can however be adapted at any time based upon new insights to improve the quality of the inventory.

The database integrates useful information that has been identified throughout the entire data collection process regarding the implementation of the measure (status, location), contact information and useful literature sources. It includes useful information on effectiveness, costs and benefits, risks and influencing factors whenever these could be identified in the data screening process.

*Dynamic and growing tool* - Considering the growing experience in Member States and the large amount of available information on measures with potential to contribute to the good status of the marine environment, it would be advisable to make the inventory a living tool which is regularly updated with measures or evaluation of measures, as the practical experience with them grows. We have already pointed at the fact that different organizations are currently working on appropriate measures for their setting and are conducting assessments on e.g. associated cost and benefits.

*Tool for Member States* – some Member States were asked to take a first look at the database and evaluate the usefulness, user-friendliness and the workability of the tool. Overall, it was indicated that the inventory could serve as a good onset for an integrated database on measures and instruments and related information (effects, costs, influencing factors). The long list of measures makes it important to have a clear understanding of the structure of the database.<sup>52</sup> Some countries define their measures in function of the targeted sectors or users which is also possible with this inventory. One respondent explicitly indicated that in the future it would be useful for Member States to deliver their experience or insights in order to come to a more exhaustive overview, both in terms of quantity of measures and the coverage of additional information on costs and benefits or effectiveness.

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<sup>52</sup> It was not explicitly suggested, but it might be appropriate to remove some columns from the database. This can be done at any point in time.

## 2 Evaluation criteria of measures

### 2.1 General considerations

Generally, evaluation of policy measures requires the use of a range of methods. The following decision support tools can be used in analysis of policies under the MSFD.

**Cost-benefit analysis (CBA)** is designed to show whether the total advantages (benefits) of a project or policy intervention – e.g. reducing nitrogen emissions to coastal waters – exceed the disadvantages (costs) – e.g. the costs to agriculture of reduced fertiliser use. This essentially involves calculating in monetary terms all of the costs and benefits, including items for which the market does not provide an observable measure of value, accruing to all affected parties. The affected parties should include not only the policy/program/project participants and consumers, but also third parties who are affected. Basically, a project represents a good investment if the aggregate benefits exceed the aggregate costs.

**Cost-effectiveness analysis (CEA)** is also used to evaluate trade-offs between benefits and resource costs. However, in contrast to CBA, the benefits are measured in units other than money. Moreover, the output (or benefit) of the policy/program/project is the same or similar for all options considered. It can be used to identify the highest level of a physical benefit given available resources (e.g. delivering the maximum reduction in risk exposure subject to a budget constraint), as well as the least-cost method of reaching a prescribed target (e.g. a given concentration level of nitrogen in coastal waters). Because less is known about the valuation of benefits in marine ecosystems than in other contexts (e.g. river water quality for the Water Framework Directive), cost-effectiveness analysis is likely to be a particularly important tool.

**Multi-criteria analysis (MCA)** has been developed to account for the fact that some effects cannot be measured, or cannot be costed. Moreover, economic efficiency may not be the sole criterion in environmental decisions. Other objectives, including flexibility, avoiding irreversibility, equity, risk and uncertainty, political sensitivity etc are important. MCA essentially involves defining a framework to integrate different decision criteria in a quantitative analysis without assigning monetary values to all factors. HMT (2003) refer to MCA as “weighting and scoring”.

## 2.2 Evaluation criteria used in the study

In developing their marine strategy, Member States must choose the measures that are best suited to cope with environmental pressures or impacts on the marine environment. Choosing between certain measures is a central and integral part of the decision making process or policy cycle and depends on numerous factors:

- Type of the environmental pressure/impact;
- Source of the pressure or impact;
- Local conditions (e.g. state of the Member States waste management infrastructure);
- Capacity to implement and enforce the instrument;
- The political will to enact policies in face of possible opposition

These factors will influence the costs and benefits a certain measure will have in the view of MSFD goals achievement for a specific Member State or subregion.

These considerations have been translated into the following criteria for evaluating measures:

- The (environmental) effectiveness of the policy;
- Costs and benefits:
  - Cost-effectiveness analysis;
  - Cost-benefit analysis;
- Suitability:
  - Status of marine waters;
  - Geographical scale;
- Social and institutional context:
  - Capacity;
  - Legal basis;
  - Equity and fairness;
- Flexibility and adaptability;
- Timing issues

### 2.2.1 (Environmental) Effectiveness

It is the responsibility of Member States to define indicators to measure the effectiveness of measures. Effectiveness usually refers to the extent to which an instrument can be expected to achieve the specified objectives. This criterion could alternatively be defined as target fulfillment or the potential of the measure to attain the established objective. In the context of the MSFD, effectiveness will be defined in terms of the measure's ability to help to achieve or maintain good environmental status (GES).

GES is defined in Art.3(5) of the Marine Directive, and it must be determined on the basis of the qualitative descriptors in Annex I of the Directive. Pursuant to Art. 9(3), the Commission adopted on 1 September 2010 a Decision on criteria and methodological standards on good environmental status of marine waters, which is

largely structured on the basis of the list of descriptors (Commission Decision 2010/477/EU): in total 11 descriptors of GES and their related indicators have been defined.

The EC's Marine Environment and Water Industry Unit has developed a document on the relationship between the initial assessment of marine waters and the criteria for GES (draft of April 2011). It aims to highlight a more explicit and integrated relationship between, on the one hand, the criteria and indicators laid down in the Commission Decision on GES criteria (which follow the structure of the list of descriptors of GES contained in Annex I to the Directive) and, on the other hand, the categories in Annex III of the Directive relating to the initial assessment of marine waters.

For each section of characteristic or pressure and impact, the document addresses the linkage with the relevant criteria and (State, Pressure, Impact) indicators of the Commission Decision on GES criteria, facilitating an integrated understanding of the various components of the Directive (in particular, between the initial assessment and progress towards achieving GES). The Table is integrated in annex 5 of this report.

Important work has also been carried out in this regard by the different regional sea organizations (discussion by HELCOM in Annex 5 to this report).

One key objective of this study is to support MS to select the set of measures most suited for their own implementation of MSFD, or in other words to select those measures best suited to achieve or maintain good environmental status. Therefore one of the criteria should be to identify the relevance of the measure with respect to the criteria for good environmental status (GES).

One difficulty that may arise in deriving the effectiveness of the measures in terms of deriving GES results from the multiple objectives – the relative importance of gains in terms of reduced marine litter compared to those of increased biodiversity to yield GES may need to be taken into account. This may lead to the need to derive a composite index of GES using weights for different indicators.

The effectiveness of (marine) measures should ideally be evaluated based upon available quantitative assessments. Therefore, the (environmental) effectiveness will be investigated in the case studies that are analyzed in Chapter 4.

An ex-ante evaluation of the effectiveness of a policy measure requires some modelling. Such models can be of various forms – either simple “mental models” based on expert judgment, partial models based on understanding of certain dynamics in the marine system or more complete models of dynamics in e.g the food webs in the marine setting.

Key questions to be answered include:

- a. How much does the proposed strategy or policy affect indicators of GES (and appropriate indices)?
- b. Are there negative impacts on any indicators of GES? What mitigation may be needed?

## 2.2.2

### Cost-effectiveness/Costs and Benefits

Cost-effectiveness can be defined in two ways in respect to conservation policy. Firstly, a conservation policy can be considered more cost-effective than others, if the sum of the costs needed to achieve a given conservation goal is lower than for the other policies. This definition is useful in a situation with a given conservation aim such as attempting to ensure the survival of an endangered species where it is of interest to find out how this goal can be achieved as inexpensively as possible. According to this definition, cost-effectiveness means that the stated objective is achieved at the lowest possible socio-economic overall cost. In other words, an instrument is cost-effective if it initiates physical measures at the lowest cost within the collective or sector at which it is aimed. In practice, this means that the cheapest measures at the margin<sup>53</sup> are carried out first. In the same way, we assess the goal achievement of the instrument in relation to its purpose before determining the contribution it makes to the overall environmental objective (Swedish Environmental Protection Agency, 2007).

The second definition concentrates on the output. In this case a conservation policy can be considered more cost-effective than others if it generates a higher level of conservation for a given amount of costs. This definition is useful, if policy makers want to maximise the conservation output for a given available budget (Ecologic, 2006).

The European Union requires in its Marine Strategy Directive that each Member State puts together an action program with cost-effective measures. Elofson (2010) has made an evaluation of cost-effective strategies against eutrophication in the Baltic Sea. For the Baltic Sea where nutrient targets are relatively demanding, this implies that measures with low costs for emission reduction at the sources and high impact on the environmental targets should definitely be included in the cost-effective strategy, but also a number of more expensive measures and measures with smaller effect.

Different types of costs are involved with the implementation of policy instruments. It is important to identify both the direct and indirect costs of implementing a specific measure, as it can involve several actors and the cost to society as a whole will be relevant. The direct cost is the cost of investment and operation associated with the implementation of measures. Indirect costs are costs associated with the policy instruments and their implementation and the policy's impact on other environmental targets and on other sectors in the economy.

We can also classify these costs according to another typology, as follows:

- **Administrative costs** for the regulator and the regulated. They consist of research, information and meeting costs, enactment and lobbying costs, design and implementation costs and administration, monitoring and prosecution costs. Most of these costs are costs of labour time for researchers, court staff, legislators, government staff and stakeholders (McCann et al., 2005).

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<sup>53</sup> The cost of reducing an additional unit of pollutant is called the "marginal cost".

- **Compliance costs** for the regulated: Investment in abatement equipment or changed behaviour, current costs of abatement or changed behaviour, administrative costs of applying for permits, etc.;
- **External costs**: Environmental and resource costs. In practical cases, these are rarely known and are usually not used when e.g. assessing cost-effectiveness.

With respect to the MSFD, **benefits** should be interpreted in the context of ecosystem services for human society or in other words, benefits stem from the goods and services the marine and related ecosystems provide. These include provisioning services (food, water, minerals, etc.), regulating services (air quality, climate change, etc.), cultural services (aesthetic, recreation, etc.) and supporting services (primary production, nutrient cycling, etc.).

Article 8(1) (c) of the MSFD requires an assessment of the cost or value of the degradation of the marine environment. Costs and benefits can be expressed in monetary terms, but this is not a requirement to call an analysis a cost-benefit analysis. Describing the values qualitatively will in many circumstances be sufficient, though it would normally be desirable to quantify or monetize the degradation where the data is available and sufficiently good.

The difficulty of estimating benefits, e.g. in CBA, is compounded by a lack of knowledge on the consequences of bad environmental status for the marine environment – either in terms of physical impacts or valuation of the impacts. For example, little has been done on valuing the benthic environment, but relatively more has been done on valuing harmful algal blooms.

With 27 Member States in the EU, the economic situation can largely differ across regions and measures suited for one area could perhaps be not possible elsewhere because of the lack of financial capacity (e.g. installing a waste management system). For some specific situations, it can e.g. be essential that the instrument helps building financial security for the long term management by generating revenues (e.g. through charges, fees). Such measures should be taken into account in the costing analysis.

Effects on the wider economy or competitiveness can be relevant. For example, where a measure may increase the cost of shipping this may have a wider impact than on the shipping industry. Exposure to competition depends on whether one operates in a global market with policies being differentiated between regions, but also the homogenous versus heterogeneous perception of the product by its consumers (Swedish EPA, 2007).

Key questions to be addressed here are:

- a. What does the measure cost?
- b. Are there any mechanisms that could be used to reduce e.g. compliance or other costs?
- c. Is the measure the most cost-effective to reach a given target?
- d. What are the quantifiable benefits in monetary terms (if possible)?
- e. How is the measure to be funded? Is there potential for revenue capture?
- f. Are there wider economic/competitiveness impacts?

### 2.2.3

#### Suitability

Measures installed will most likely differ in several ways, for example in the way they affect the pressures or impacts they address or in the preconditions that must be met before they can be installed. The suitability to adapt to the different situations in the EU will be an important element for the Member States when building their marine strategy.

However, it is important to notice that not all measures are exchangeable between Member States, even if they tend to be good practices in a specific Member State. The suitability of an instrument will depend on several factors, thus requiring different criteria for evaluation:

- Status of the marine waters: certain measures used for marine situations with minimal pressure on the ecological status are barely effective / or efficient for largely polluted sites. Others may only work in certain physical conditions (e.g. certain water depth).
- Geographical scale: Some measures can only be implemented very locally and others need national or even international implementation/monitoring. Examples of the latter may include the monitoring of marine pollution, where satellite detection systems may be needed to identify oil pollution – requiring national implementation as a minimum scale.

Key questions:

- a. Is the measure appropriate for the physical conditions? Is the measure technically feasible? What adaptations would be needed/possible?
- b. Is the measure at the appropriate scale?

### 2.2.4

#### Social and institutional context

Nations vary in their direction and stages of economic, social and political development, all of which affect their ability to respond to environmental problems. Measures can be launched and be effective only if the regulatory framework and institutional infrastructures are in place. Nations also differ in their ability to afford the expenses associated with the various programs. The relevance and effectiveness of any instrument will need to be assessed on a case-by-case basis to determine its potential for success.

An important question or criterion could also be if the instrument and the rationale behind it is understandable and deemed credible by the public, politicians, targeted groups and other stakeholders? Can people understand how it will work, and how they should respond? This relates with both public and political acceptance and understanding and largely determines the extent to which the instrument can attain its goal. Key questions include:

- a. Is capacity available to implement and enforce the instrument? What are the gaps?
- b. Does an institutional context and legal basis for the instrument exist? The actual implementation (feasibility) of the instrument can be (negatively) influenced if new laws need to be passed. With regard to responsibilities, it

can e.g. be important to evaluate who controls the revenues stemming from the measure (regional, national) or the overall climate of supervision.

- c. Is the measure politically acceptable?
- d. What is the distributional impact of the policy? What mitigation measures may be needed? Equity and fairness of policy instruments should therefore be considered. According to the OECD, a characteristic feature of economic instruments is that they affect the cost and benefit of choices made by those concerned. This may be seen as a manifestation of the "polluter pays" principle. The distributional impact of the policies in terms of whether a measure is regressive or progressive should also be taken into account, or impacts on socially disadvantaged groups identified.

## 2.2.5

### Flexibility and adaptability

Policy instruments are designed to certain impacts and pressures given certain preconditions. It is therefore of key importance that the instrument can respond when one or more of these elements are changing, e.g. technological development or actors involved.

Usually, there are two main aspects of flexibility to be considered. First, the ability of the instrument to continue to be effective when circumstances are changing (prices, public policy, conditions). Second, flexibility also reflects the degree to which individual firms may choose their own responses within the context of the overall governmental goal.

One option that certainly fulfils the latter is that of tradable permits. Tradable (emissions) permits systems are based on the principle that firms with the lowest marginal cost will be the first to implement the measures to reduce their emissions, rather than the government obliging every company to reduce emissions with a certain level. However, other measures also may allow flexibility.

Another example is the management of MPA which should be actively adaptive in relation to improved knowledge about species dynamics. This is essential in order to react to non predicted changes in the ecosystem and its uses (IFREMER, 2004).

Key questions include:

- a. Are the measures robust to likely scenarios of change? This would necessitate the use of sensitivity analysis.
- b. Is there freedom for individual firms to choose responses?

## 2.2.6

### Timing Issues

Timescale will be important in order to assess the actual or expected impacts of a policy instrument in relation to its original objectives. Policy makers may be seeking a particular effect for a specific period, e.g. during a time of adjustment or transition. However, many policy measures have no time limit, even though the economic or political target has already been achieved or it has been confirmed that the target is actually not achievable.

Returning the marine environment to good environmental status will take time, because of the long time periods involved. Depending on the time lag between the implementation of a measure and its effect on the GES, different measures could be cost-effective at different moments in time. In the example of eutrophication of the Baltic Sea (see Elofson, 2010), there could be an advantage with early abatement in the coastal zone in order to have a rapid effect on the sea, followed later on by inland measures. For applied case studies, the inclusion of time dynamics requires information about ecosystem response to changes in loads.

Key questions include:

- a. Does the measure deliver GES in the timeframe of the MSFD?
- b. Is it technically possible to deliver in the timeframe? What derogation measures may be needed?

### **3 Ex ante evaluation and key success or limiting factors**

In this chapter, it is anticipated in which way a measure would satisfy the set of criteria developed in the previous section. More importantly, key success / limiting factors are identified that would be needed for (mix of) measures to be cost-effective and flexible.

#### **3.1 Brief assessment of identified measures**

##### **3.1.1 Framework for ex ante evaluation**

The criteria identified in the previous chapter are intended for assessment in the case where an instrument is being considered for implementation in a particular case – and hence can be usefully used in assessing particular instruments in case studies. An ex-ante evaluation of a range of policy measures such as this requires a more general set of criteria, as is developed in the following Table. As can be seen, this is limited to a qualitative assessment based on our expert judgment and a review of the relevant literature.



Table 10 : Comparison of criteria under full analysis and quick scan

Criteria	Measurement in full analysis for case studies	Measurement in Quick Scan	Notes
(Environmental) Effectiveness	Modelling of effectiveness in meeting GES - using mental models, partial models of certain marine dynamics or more complete models	Expert judgment and synthesis from existing literature on a scale from "---" to "+++" (strong negative impact on individual element of GES to strong positive impact)	
Costs and benefits	Cost-effectiveness and cost-benefit analysis where possible	Expert judgment and synthesis from existing literature on financial cost of scheme – levels of charges and implementation costs where available. Expert judgment on potential for wider economic impacts.	
Suitability	Assessment of optimal scale of instrument, technical feasibility and appropriateness for physical condition of marine waters	Usual scale of instrument (local, national, transboundary), expert judgment on ambient conditions needed for implementation	
Social and institutional context	Evaluation of capacity to implement instrument, existence of a suitable legal and institutional context, evaluation of political acceptability, assessment of distributional impact using modelling and assessment of mitigative measures for regressivity	Expert judgment and synthesis from existing literature on distributional impact - 3 point scale - regressive, neutral and progressive. Defining institutional needs for a given policy is difficult because of the different structures in each MS. More detailed analysis of the institutional context is not possible in this ex ante assessment but will be considered for the selected case studies.	
Flexibility and adaptability	Evaluation of robustness of instruments to scenarios of change and of freedom to choose appropriate response by firms	None	Any assessment requires specific analysis
Timing	Evaluation of whether the measure delivers within the timeframe of MSFD and technical feasibility of meeting GES objectives	None	Any assessment requires specific analysis



This means that the following **key criteria** can be identified:

- Evaluation of environmental effectiveness: if an instrument has a negative impact on an indicator of GES or a high cost/GES indicator ratio then this may not be the preferred policy choice;
- The cost of the measure:
  - If the net benefit of a measure is negative then this suggests a measure may not be cost-effective.
  - If there are wider economic impacts these would require careful assessment on a case by case basis.
- The suitability of the measure:
  - If particular ambient conditions are needed for implementation and these are not present in the case in question then the measure may not be effective;
  - The scale (local, national, transboundary) needed for effective implementation – if the level is not appropriate for the case in question then the measure should be considered not effective for the given context;
- The social impact of the measure: Assessment of distributional effects – highlighting when a policy has a negative (regressive) impact or a positive (progressive) impact. If negative then the measure may need mitigation measures to correct for this.

### 3.1.2

#### Results of the ex ante evaluation

#### 3.1.2.1

##### Key considerations

Marine environments are characterised by a number of factors that make the application of policy instruments difficult. These include:

- a. Open access – an issue which has been widely discussed in the literature on environmental policy. Open access may affect the effectiveness of policy instruments that target particular types of users of marine space, as other users may move into these areas;
- b. Transboundary pollution movement – this raises particular issues when the impacted population is not in the same jurisdiction as the pollution source. The dispersion of pollutants in the seas naturally means this is a major issue. Here lessons can be learnt from measures developed in the riverine context, where the dynamics of the water system is more linear;
- c. Mixing pollutants – mixtures of pollutants have been shown to have differing impacts on marine organisms – e.g. the emission of contaminants into eutrophied waters may result in significantly different effects than the same emissions in waters that are not characterised by eutrophication. This poses important issues for the design of appropriate policy in the allocation of the burden of the damage cost to the pollutant in the case of environmental taxes and in the identification of the appropriate command and control measure to address any given marine pollution issue.
- d. Complexity – marine systems are by nature more complex than riverine systems, where we might draw lessons for appropriate policy

in the MSFD context. The scientific complexity poses important questions for appropriate policy setting – where the impact of pollution is affected by factors such as differing levels of salinity, different rates of mixing in the water column and water temperature. The base of scientific knowledge on the seas is generally considered to be lower than that on limnetic and riverine systems.

It is well known that market-based instruments such as environmental taxes and tradable emission permits should lead to a **cost-effective** achievement of environmental targets, whereas command-and-control instruments will not by nature. The reason is that taxes and tradable emission permits give market incentives for low-cost polluters to abate more and high-cost polluters to abate less. With command-and-control measures, i.e. when the emission level or technology is regulated for each polluter, the allocation of abatement will not be cost-effective unless the regulating agency knows the abatement costs for each single polluter, which is hardly ever the case (Elofson, 2010).

The more the marginal cost of treating emissions differs from one emission source to another, the better the results will be that market-based instruments offer in terms of cost-effectiveness as compared with quantitative regulation. The complications for the marine system may be that mixed pollutants are more difficult to address under a tradable permits system and the spatial variation in background factors such as salinity and the mixing of water columns may lead to the need for restrictions on the free trade of permits or spatially differentiated taxes on emissions in coastal and marine systems. Similar issues have arisen in e.g. nitrate sensitive zones in the riverine context.

Taxes will always be cost-effective within the collective on which they are imposed, provided that the location of the emission source is not a factor in the environmental impact it causes. Where the location of the emission source plays a part in the environmental damage, geographical differentiation of the instrument may benefit cost-effectiveness – and this is likely to be the case in the marine pollution context. However, if the additional administrative cost of a differentiated instrument is high, it may still be advisable to set up uniform instruments.

Command-and-control directed towards emissions as well as tradable emission permits will in the general case lead to **target achievement** with relatively high accuracy as the total level of emissions is in that case directly controlled by the policy maker. However, this situation occurs assuming complete information and complete compliance. It presupposes that the regulatory authority has full information about abatement costs in that industry, which requires extensive resources. In case of only a few emission sources and low information costs, command-and-control regulation may be advisable. However, if it is difficult to achieve full compliance due to monitoring problems, for example, it may be advisable to use economic instruments as a complement to regulation. The difficulties of imperfect information are likely to pervade the marine context – particularly with the diffuse nature of some of the industries involved. The multiple number of industries using the marine environment also makes command and control more difficult.

In terms of subsidies, the big challenge for governments obviously is to allocate public funding only to those projects that are socially beneficial and would not have

been carried out in the absence of a subsidy. This is however not straightforward as private stakeholders always have an incentive to apply for public funding. It could be the case that a subsidy merely replaces private money (crowding out) and does not engender additional investments. Thus, a key question with regard to any public sector support is one of **additionality** i.e. the extent to which funds would or would not have been spent by the private sector in the absence of public sector provisions. Case studies investigating regional, social and economic impacts of change in fisheries-dependent communities (Arthur et al., 2011) show that large infrastructure projects generally show high levels of additionality, but funds used on fleet measures often generate lower additionality.

Market-based instruments are generally **flexible** with regard to changes in the economic environment, as less administrative burden is generally required to adjust these measures. This may be particularly important in marine contexts, where the understanding of science and the diverse nature of sectors exploiting the marine system mean there may need to be significant changes in regulations over time. Because of their flexibility, economic instruments are traditionally discussed in contrast to regulatory or “command-and-control” instruments. However, many examples of effective achievements of environmental policy targets illustrate the need for a combination and integration between regulatory and economic instruments (Mattheiβ et al., 2009).

The size of **transaction costs** is likely to be determined by the type of environmental problem (higher in case of nonpoint source or diffuse pollution which is likely to be often the case in marine contexts) and the design of the policy instrument. Transaction costs are relatively large for command-and-control systems, compared to other policy instruments. In the former, the government needs to determine costs and effects of measures for each individual polluter. Empirical evidence suggests that transaction costs can also be a considerable obstacle to permit trading when these costs are not been taken into account when designing the system.

Increases in environmental taxes can on the other hand meet considerable **political resistance**, making it difficult to reach a political agreement about setting taxes on the economically optimal level. Both direct regulation and tradable emission permits (with permits being distributed to the polluters at zero cost), are likely to meet less resistance. In the marine context, resistance may be strong from certain sectors with significant influence. These may include tourism, defense and fisheries.

The **distributional impact** of policy instruments is determined by the costs that different parties incur. Here, command-and-control legislation is attractive to polluters because they only need to pay for actual abatement. Although total abatement costs become lower with taxes than with command-and-control (because of the lower cost-effectiveness of the latter), this is more than outweighed by the costs for tax payments. The costs to polluters are equal for environmental taxes and tradable emission permits, provided that emission permits are distributed through auctions. However, environmental taxes or permit

auctions deliver an additional income to the government, which can be used to overcome potential distributional distortions (Elofson, 2010). Distributional concerns may be particularly significant in the implementation of the MSFD, given the socioeconomic nature of coastal communities.

### 3.1.2.2

#### Quick scan results of a selection of measures

The list of measures contained in the inventory was examined and broadly the instruments could be allocated to the categories identified in the following Table. Below, we evaluate the impact of a category of measures, drawing on literature from case studies around Europe where this exists. A detailed evaluation of each measure would require significant primary research, which is beyond the scope of this project.

The qualitative assessment of **environmental effectiveness** attempts to identify those measures with the largest impacts by criteria of GES – i.e. the columns are broadly comparable vertically. Comparing impacts across different characteristics of GES is difficult and will need detailed evaluation which can only be done at a detailed case study level. Several studies evaluate the potential effectiveness of economic instruments (though generally not in terms of the impact on marine environments) including Keep Wales Tidy (2006) and Eftac, IEEP et al (2010).

In terms of the **costs**, where possible, examples from existing or proposed schemes have been identified. Costs have been presented both in terms of the rates of economic instruments and the implementation costs of policies, drawing on examples around Europe. For wider economic impacts, the scale reflects expert judgment of the study team on the potential for such costs.

The social impact is presented in terms of an evaluation of the **distributional impact**. Here, we draw on existing studies of the burden of environmental taxation (e.g. Warren, 2008; Defra, 2007). Key impacts may be on socially disadvantaged groups, such as fishermen.

**Benefits** are difficult to measure: Generally, benefits are difficult to assess in monetary terms in the marine context and so these are not discussed in this section. However, it is useful here to note the work of the THRESHOLDS ([www.thresholds-eu.org](http://www.thresholds-eu.org)) and the KNOWSEAS project ([www.knowseas.com](http://www.knowseas.com)) both of which have produced databases of values that are available from the literature.

We note that the Marine Strategy Framework Directive, under Article 14, includes the provision that Member States will not be required to take action where the costs are disproportionate or where the risks are “not significant”<sup>54</sup>. It is beyond the scope of this project to define what “disproportionate” costs are or to define the significance levels of risks to the marine environment. This will be the topic of much debate in the coming years.

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<sup>54</sup> “Member States shall develop and implement all the elements of marine strategies referred to in Article 5(2), but shall not be required, except in respect of the initial assessment described in Article 8, to take specific steps where there is no significant risk to the marine environment, or where the costs would be disproportionate taking account of the risks to the marine environment, and provided that there is no further deterioration.” (Article 14, paragraph 4 of Directive 2008/56/EC).

The results of the application of the Quick Review criteria developed above to the major policy measures identified is presented in the following Table 11 and Table 12, preceded by some key findings of this exercise:

*A mixture of policies is needed to implement the MSFD*

It can be seen that not one instrument impacts on all categories of GES. This is significant – as it implies that a **policy mix** will be needed to implement the MSFD. Policy mixes are suggested to be useful for a number of reasons – including that social measures may positively impact on the outcomes of economic instruments and command and control measures.

*Direct impacts on the marine environment of economic instruments may be limited in some cases – unless revenues are used to improve coastal waters.*

Instruments such as tourist taxes are likely to have a very limited direct impact on the marine environment, because of the relatively low charges needed to ensure political acceptability to be enough to change behaviour<sup>55</sup>. However, given that the level of any tourist eco-tax would need to be relatively low for political acceptability, it is unlikely that significant changes in tourist behaviour will result. However, they may be effective in meeting environmental effectiveness critique if revenues are used for environmental remediation.

*There is the need for cross-compliance with and in other European policies.*

Negative impacts may be anticipated from measures in other sectors, e.g. waste management strategies which may increase the incentives to illegally dump if price for waste collection increases. It is important that other objectives of EU policy be implemented consistently with the MSFD – and indeed that potential “win-win” measures be identified when implementing e.g. the Water Framework Directive or agricultural policy.

*Costs of policies to support the implementation of the MSFD may differ dramatically*

On the costs side, there is great divergence in the rates of charges and in potential costs depending at the same time on measures, locations and technical specifications of policies. The most costly measures may include the installation of tertiary waste water treatment and deposit recovery schemes. However, it should be noted that we have not investigated in depth the issue of cost-recovery – and both of these may have significant potential for this through charges and the failure to collect on a proportion of deposits for bottles, for example. Little exists on the costs (and benefits) of e.g. information based measures (e.g. awareness raising).

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<sup>55</sup> In a meta-analysis of 44 studies, Crouch and Shaw (1992) found that the average price elasticity of demand for tourism was (-)0.39, suggesting that a 1 percent increase in price of tourism would lead to a 0.39 percent reduction in the numbers of tourists. Recent work for the UK suggests a price elasticity of demand for tourism of 2.5 to 3 (Durbarry, 2008<sup>55</sup>).

#### *Cost-effectiveness of policies will be spatially specific*

Depending on the limiting factors in marine waters, different measures may be more or less effective. The cost-effectiveness of policies affecting nutrient balances will vary depending on factors such as mixing of nutrients and the extent to which other nutrients are available (the NPK balance). Considered in isolation from riverine benefits, actions to reduce nutrients in the North Sea may be costly – in part because existing infrastructure means that improvements will likely be marginal and at high cost, particularly in terms of waste water treatment. In the case of the Baltic, the net benefits may be positive – and in the Mediterranean with higher recreational values placed on clear waters actions to reduce eutrophication and existing technologies are not as modern as those e.g. in the North Sea, which means that the cost-benefit ratio is likely to be more positive there.

#### *Some potential for win-win solutions in MSFD*

Some policies may appear to be win-win – e.g. in terms of the placing of bivalves around fish farms to mitigate impacts of waste matter on the benthic environment there may be a net financial gain to the producer because of the potential to sell the mussels. These estimates assume that the mussels grown that feed on waste matter can be harvested and sold – depending on the case this may or may not be reasonable (Taylor & Holmer, 2009).

Ecolabelling may present another example for win-win”, though this depends again on the criteria used to define the green label. Labelling can lead to a premium on the price, which may more than offset the cost of compliance with the standards required. For this option to be win-win, two factors are important:

- The criteria need to be tight enough to lead to environmental improvement; and
- The cost of verification clearly also needs to be below the premium for the ecolabel. Factors that affect the cost of verification include the extent to which detailed testing of products and the administrative burden on companies of compliance with the standards. The premium depends on how the ecolabel is perceived – which may be influenced by the number of different ecolabels in the market and the extent to which the market has been penetrated by products with an ecolabel. The level of consumer awareness also influences the willingness to pay.

#### *Allocation rules matter for cost of permits*

The net cost of tradable permits is partly determined by the allocation process e.g. free grandfathering means no revenue gain for the government, whereas permit auctions may raise significant sums (Cramton and Kerr, 1998).

#### *Scale may impact on cost*

The optimal scale of an instrument varies significantly between measures. The potential (cost) advantages are worth mentioning linked with cooperation in monitoring and enforcement, e.g. at regional seas level. Examples with potential (existing implementations) are disaster management, surveillance activities or some monitoring systems.

*Wider economic impacts may only be anticipated in certain cases*

In general wider effects on the economy of the measures identified are considered to be “unlikely”. However, this depends on the assumption of a marginal change in costs. For example, if commercial fishing fees affect the catch then this may have associated impacts on associated industries. In some cases, e.g. habitat banking, the wider economic impacts may be positive in removing inefficient barriers to development.

*Distributional impacts may vary significantly between instruments*

For a number of policies, the distributional impact depends on how budgets are raised. In case of a general tax, this will be as regressive or progressive as the general tax system. If revenues from an ecotax are used to reduce general labour taxes, it should also be noted that the potential for a “double dividend” exists – whereby distortionary labour taxes are reduced and so there are welfare gains.

The tables below show the result of assessments of a number of measures from the inventory using the Quick scan method, as examples. Clearly, only broad comparisons can be made between instruments based on these criteria. Ideally, policy assessment in the context of the MSFD will consider the application of multiple policy measures in unison – considering one in isolation may not lead to the optimal outcome because of the potential interactions.

Table 11: Assessment<sup>56</sup> of the (environmental) effectiveness of some inventoried policy measures<sup>57</sup> using the Quick Scan method: some examples

	Qualitative Impact on GES indicators										
	1) Biological diversity is maintained	2) Non-indigenous species	3) Populations of all commercially exploited fish and shellfish	4) All elements of the marine food webs	5) Human-induced eutrophication is minimised	6) Sea-floor integrity	7) Permanent alteration of hydrographical conditions	8) Concentrations of contaminants	9) Contaminants in fish and other seafood for human consumption	10) Properties and quantities of marine litter	11) Introduction of energy, including underwater noise
<b>Economic Instruments</b>											
Fee-based measures											
Plastic bag tax	+	+							+	++ significant reduction in plastic bag litter in Ireland based on a number of studies following introduction of a levy (Keep Wales Tidy, 2006).	
Deposit-refund schemes for bottles	+	+							+	++ reduction in marine litter, increased reuse. However if good recycling scheme in place may be small effect (Ecotec, 2001). Note marine environment would not be sole target.	
Tourist taxes	No direct impact on behaviour - impact depends on use of tax for environmental improvement. Unlikely to be set at levels that affect number of tourists.										
Charges for car parking										? Unlikely to be set high enough to significantly reduce visitor numbers	
Commercial fishing fees	++	+	++	++		+				+	
Recreational fishing fees	+	+		+						+	
Charges for waste services including landfills										- to --- as may encourage illegal dumping	
Aggregate taxes/levy	?			?		Depends on level of tax - Danish case + (Ecotec, 2001)					
<b>Subsidies</b>											

<sup>56</sup> The approach is a qualitative assessment based on our expert judgement and a review of the relevant literature. The results for a selection of examples of measures are shown, drawing on literature from case studies around Europe where this exists. In the Excel inventory, the information quality is assessed. A detailed evaluation of each measure would require significant primary research, which is beyond the scope of this project. The key is as follows: "+" indicates a likely minor impact (usually when the GES indicator would not be the main target for the measure); "++" indicates a likely moderate impact; "+++" indicates a strong impact; "?" indicates the case where there may be an impact, but the scale is hard to measure.

<sup>57</sup> It is of note that the developed inventory tool (separate file in excel format) includes the relationship between the inventoried measures, pressures and impacts (Annex III, table 2 of MSFD), uses and GES-descriptors (Annex I of MSFD). The structure of the inventory has been described in detail in paragraph 1.2.

	Qualitative Impact on GES indicators										
	1) Biological diversity is maintained	2) Non-indigenous species	3) Populations of all commercially exploited fish and shellfish	4) All elements of the marine food webs	5) Human-induced eutrophication is minimised	6) Sea-floor integrity	7) Permanent alteration of hydrographical conditions	8) Concentrations of contaminants	9) Contaminants in fish and other seafood for human consumption	10) Properties and quantities of marine litter	11) Introduction of energy, including underwater noise
Financial support for the installation of waste management systems on board of ships	+	+		+	+					++	
Other (e.g. trading systems, liability and compensation regimes)											
Tradable fishing quotas	++	+ as some evidence that overfishing aids alien species	+	++							
Habitat banking	++		+	+		++					
<b>Command and Control</b>											
Regulation (including e.g. bans)											
Ban on nets damaging to benthic environment	?			++		+++					
ban on the discharge of sewage water from passenger ships and ferries	+		+	+	+			+			
Compulsory construction of WWTP					++			+			
Norms (and control systems)											
Reduction in phosphates in detergent	?			?	++ depending on region						
Compulsory bioremediation (e.g. bivalves on fish farms)				+	+	++ potential significant impact on benthic impacts (Taylor and Holmer, 2010)					
Fines for littering and illegal waste disposal	+	+						+	+		
Zoning or spatial control of activities											
Designation of Marine Protected Areas	++		++	++		++					+
Regulation of areas where fishfarms can be located to avoid interaction with migratory fish	+	++	+	+							
Redesignation of shipping lanes	++ if reduced noise reduces impacts on e.g. whales										
<b>Social measures</b>											

	Qualitative Impact on GES indicators										
	1) Biological diversity is maintained	2) Non-indigenous species	3) Populations of all commercially exploited fish and shellfish	4) All elements of the marine food webs	5) Human-induced eutrophication is minimised	6) Sea-floor integrity	7) Permanent alteration of hydrographical conditions	8) Concentrations of contaminants	9) Contaminants in fish and other seafood for human consumption	10) Properties and quantities of marine litter	11) Introduction of energy, including underwater noise
Ecolabelling	Possible +, depends on criteria for ecolabelling			+ as appropriate fish farming may reduce interactions with wild fish	Possible +, depends on criteria for ecolabelling	Possible +, depends on criteria for ecolabelling		Possible +, depends on criteria for ecolabelling			
Award-based incentives for coastal cities (integrated waste management)	+			+						++	
Awareness programs	Quantification of impacts difficult										
<b>Technical, technological and research based measures</b>											
Increased beach cleaning	+	+		+ ??						++	
Increased recyclability of plastics				+ ??						+	
Stabilisation / solidification of sediments								+			

Table 12 : Assessment<sup>58</sup> of Cost, Suitability and Social context criteria of some inventoried policy measures using the Quick Scan method: some examples

	Cost		Suitability		Social context
	Burden of measure		Needs of measures		Distributive impact
	Costs: Level of Charge and Implementation Costs	Wider economic impacts	Particular ambient conditions needed?	Scale	
<b>Economic Instruments</b>					
Fee-based measures					
Plastic bag tax	Ireland - €0.15 per bag. Costs: €1.2mn one-off set up costs. Annual costs €350,000. Advertising campaign €358,000. (Convery et al, 2007) <sup>59</sup>	Unlikely	No	Local/national	Neutral or progressive (based on Keep Wales Tidy, 2006)
Deposit-refund schemes for bottles	UK – Scheme proposed by CPRE (NGO) including both glass and plastic bottles - £84mn setup cost, £700mn annual running cost net of revenues. Low cost to producers because of unclaimed deposits. Savings of £160mn for local authorities due to reduced waste management needs. Significant net air pollution benefits (£69mn) and amenity benefits (£1.2bn) – Hogg et al 2010  Denmark: €0.15-€0.40 per bottle depending on type (Ernst and Young, 2009 cited in Hogg et al, 2010)  Sweden: \$0.14 to \$0.56 depending on the PET bottle (Ernst and Young, 2009 cited in Hogg et al 2010). <sup>60</sup>	Unlikely (Ecotec, 2001)	No	National (but could also be regional)	Neutral or progressive. Ecotec (2001) found no distributional analysis on this in Europe.
Tourist taxes	Croatia: approx. €1 per person per night  Germany: bed tax not exceeding €10 per night can be charged according to municipal statutes  (CMS, 2008) <sup>61</sup>	Unlikely	No	Local/national	Neutral (does not consider tax shifting across borders) - Warren (2008)
Charges for car parking	Locally determined.	Unlikely - depends on level of charge	No	Local	Likely neutral
Commercial fishing fees		Possible	Controllable fishing landings	National/transboundary	Possibly regressive
Recreational fishing fees	UK: rod licences (salmon, trout, freshwater fish, smelt or eel): £27 to £72 per annum (full rate, concessions apply) <sup>62</sup>	Unlikely	Controllable access	Local	Depends on incomes of recreational fishers.
Charges for waste services including landfills	UK: Landfill tax: £56 per tonne standard rate (2011)  Ireland: Landfill levy €30/tonne	Possible	No	National	Neutral - no link between income and waste generated (Defra, 2007)

<sup>58</sup> The approach relies on a review of the relevant literature and our expert judgement. The results for a selection of examples of measures are shown, drawing on literature from case studies around Europe where this exists. In the Excel inventory, the information quality is assessed. A detailed evaluation of each measure would require significant primary research, which is beyond the scope of this project.

<sup>59</sup> Convery, F., McDonnell, S., and S. Ferreira (2007) "The most popular tax in Europe? Lessons from the Irish plastic bags levy". *Environmental and Resource Economics* 38:1-11.

<sup>60</sup> Hogg, D, et al (2010) "Have We Got the Bottle? Implementing a Deposit Refund Scheme in the UK. Report for the Campaign to Protect Rural England by Eunomia.

<sup>61</sup> CMS (2008) "Principle Hotel-Specific Laws in Europe and China: Summer 2008". Available online at [www.cmslegal.com](http://www.cmslegal.com)

<sup>62</sup> Environment Agency (2011) "Buy your rod licence online". [www.environment-agency.gov.uk/homesandleisure/recreation/fishing/31497.aspx](http://www.environment-agency.gov.uk/homesandleisure/recreation/fishing/31497.aspx) Accessed August 2011.

	Cost		Suitability		Social context
	Burden of measure		Needs of measures		
	Costs: Level of Charge and Implementation Costs	Wider economic impacts	Particular ambient conditions needed?	Scale	Distributional impact
	France: Landfill tax €7.50/tonne for those with EMAS/ISO140001 (2003) (Bartelings et al, 2005, cited in <a href="http://www.economicinstruments.com">www.economicinstruments.com</a> )				
Aggregate taxes/levy	UK: £2 per tonne standard rate. Implementation of ISO140001 -£0.03 to £0.08 per tonne, £0.02 to £0.045 per tonne recurring costs (HMRC, undated) <sup>63</sup>	Unlikely (Ecotec, 2001)	No	National	Neutral (Ecotec, 2001)
<b>Subsidies</b>					
Financial support for the installation of waste management systems on board of ships		Unlikely	No	Local/National	Depends on how funds raised and distributed
<b>Other (e.g. trading systems, liability and compensation regimes)</b>					
Tradable fishing quotas	Costs of quotas depend on methods for allocation of permits. Netherlands: ITSQs for sole costing \$30 per kg (1997 – cited in Arnason, 2002 <sup>64</sup> )	Unlikely	Yes - controllable landings	National/transboundary	Neutral to Regressive depending on whether scheme leads to a concentration of permits in the market.
Habitat banking	UK: Estimate for costs of habitat banking by management agreement costs £4,509 to £48,758 per ha (coastal) (GHK, 2011) <sup>65</sup>	Probable - facilitates development	No	Local/National	Neutral - private finance (eftec, IEEP et al, 2010)
<b>Command and Control</b>					
<b>Regulation (including e.g. bans)</b>					
Ban on nets damaging to benthic environment	Costs will depend on measures taken by fishermen – may not be sizeable	Unlikely if relatively small movements	Most likely in areas with significant benthic environments	Local / national / transboundary	Impacts on fishermen - possibly regressive
Ban on the discharge of sewage water from passenger ships and ferries	Variable depending on need to retrofit. Lower cost for new build.	Unlikely	No	Transboundary	Likely neutral
Compulsory construction of WWTP	France: Present value costs could be €115 to €425 per resident for tertiary treatment (Thieu et al, 2011) <sup>66</sup>	Unlikely	Yes – depends on existing treatment and feasibility	National	Depends on how funds raised
<b>Norms (and control systems)</b>					

<sup>63</sup> HMRC(undated) Aggregates Levy: Regulatory Impact Assessment. Available from [www.hmrc.gov.uk](http://www.hmrc.gov.uk)

<sup>64</sup> Arnason, R. (2002) "A Review of International Experiences with ITQs" CEMARE report 58. Available online from [www.port.ac.uk/research/cemare/](http://www.port.ac.uk/research/cemare/)

<sup>65</sup> GHK (2011) "Costing potential actions to offset the impact of development on biodiversity". Report to Defra,

<sup>66</sup> Lancelot, C. et al (2011) "Cost assessment and ecological effectiveness of nutrient reduction options for mitigating Phaeocystis colony blooms in the Southern North Sea: An integrated modelling approach" *Science of the Total Environment* 409:2179-2191.

	Cost		Suitability		Social context
	Burden of measure		Needs of measures		
	Costs: Level of Charge and Implementation Costs	Wider economic impacts	Particular ambient conditions needed?	Scale	Distributional impact
Reduction in phosphates in detergent	UK: Cost of reduction to at least 0.4% of phosphorous for all domestic laundry cleaning products: One off costs £10mn, Average annual cost: £5-8mn (UK Defra, 2009) <sup>67</sup>	Unlikely	Yes - depends on limiting factors in marine area eg NPK balance	National	Depends on consumption of detergents by households with different incomes
Compulsory bioremediation (e.g. bivalves on fish farms)	DK: Cost of mussel farm approx. 6mn DKK, operation costs 2.7mn/annum (Taylor and Holmer, 2009) <sup>68</sup>	Unlikely	Design of cages may affect practicality	National	Likely progressive
Fines for littering and illegal waste disposal	UK: £50-2500 fine for littering, up to £40,000 or 6 months in prison for dumping waste illegally Sweden: 800kr fine for littering (in €?)	Unlikely	No	Local/Regional/National	Depends on nature of fines – can be set on “affordability” basis to mitigate some regressive impacts.
<b>Zoning or spatial control of activities</b>					
Designation of Marine Protected Areas	Establishment costs identified in non-EU cases range from \$41 per sq km to \$3.2mn per sq km (McCrea-Strub et al, 2011) <sup>69</sup>	Possible	Yes - area of significance	Local / national and transboundary	Neutral
Regulation of areas where fish farms can be located to avoid interaction with migratory fish	Costs likely small - if distances not large	Unlikely	Yes - necessitates areas without migratory fish transport	Local / national	Neutral
Redesignation of shipping lanes	Negligible to small depending on distances	Unlikely if relatively small movements	Areas with species impacted by marine noise	National / transboundary	Likely neutral
<b>Social measures</b>					
Ecolabelling	MSC ecolabel costs annual fee \$250 to \$2,000 depending on value of certified seafood sold or purchased. Certified fisheries incur no annual costs from MSC. Cost of pre-assessment from several thousand to 20,000 USD, and full certification \$10,000 to \$100,000 depending on size (Peacey, 2000) <sup>70</sup>	Unlikely	No	National / transboundary	Progressive
Award-based incentives for coastal cities (integrated waste management)		Unlikely	No	Likely local/national	Depends on how funds raised
Awareness programs	Costs vary significantly from case to case.	Unlikely	No	Local/national	Depends on how paid for
<b>Technical, technological and research based measures</b>					
Increased beach cleaning	Will depend on existing activities. UK: £14mn/yr spent by local authorities, industry and	Unlikely	Possible - access to beaches	Local	Depends on how paid for

<sup>67</sup> UK Defra (2009) Impact Assessment of Ban on Phosphorous in Domestic Laundry Cleaning Products. Final version. Defra, London.

<sup>68</sup> Taylor, T. and M. Holmer (2009) “Preliminary cost-effectiveness and cost-benefit analysis for the fish farm case study” Annex II to D6.3.2. of the Thresholds project (Project 003933) for the European Commission.

<sup>69</sup> McCrea-Strub, A, et al (2011) “Understanding the cost of establishing marine protected areas” *Marine Policy* 35:1-9.

<sup>70</sup> Peacey, J. (2000) “The Marine Stewardship Council Fisheries Certification Program: Progress and Challenges” in Proceedings of the Tenth Biennial Conference of the International Institute of Fisheries Economics and Trade, July 10-14 2000, Corvallis, Oregon. Edited by Robert S. Johnston and compiled by Ann L. Shriver. IIEFT, Corvallis, Oregon.

	Cost		Suitability		Social context
	Burden of measure		Needs of measures		
	Costs: Level of Charge and Implementation Costs	Wider economic impacts	Particular ambient conditions needed?	Scale	Distributional impact
	communities. Den Haag: €630,000 per year (2004) (KIMO, 2009) <sup>71</sup>				
Increased recyclability of plastics	Depends on measures – e.g. if simple technology transfer then may be less than if significant R and D needed..	Possible	No	Local/national	Neutral (if internalised)
Stabilisation / solidification of sediments	Nordic studies show cost of between €10/m <sup>3</sup> (Nordsjo harbour, Finland) to €50/m <sup>3</sup> (Trondheim pilot, Norway) (Laugesen et al, 2006 cited in Sparrevik et al, 2007) <sup>72</sup>	Unlikely	Yes - benthic environment must be suitable for technologies used	Local/National	Depends on how funds raised

<sup>71</sup> KIMO(2009) Marine Litter: KIMO Resolution 1/09. Kommunenes Internasjonale Miljøorganisasjon – available online at [www.kimointernational.org](http://www.kimointernational.org)

<sup>72</sup> Sparrevik, M. et al (2007) "Stabilisation and Solidification of Contaminated Sediments: State of the Art report" Prepared by NGI.

## 3.2 Success and limiting factors

In this section we present collected insights and theoretical considerations on success, limiting and enabling factors for measures implemented to maintain or improve the marine environment. Success factors are preconditions or elements of policy design that are critical to the effective implementation of the measure. Limiting factors are those which restrict the application of the measures. Enabling factors are those which can mitigate the influence of limiting factors.

Section 3.2.1.1 summarizes the elements identified through the extensive data collection process from the inventory of measures. The next paragraph 3.2.1.2 further elaborates on this information and underpins the results with theoretical background elements and additional evidence. Section 3.2.2 presents the conclusions in terms of key success / limiting factors that would be needed for measures (and mix of measures) to be cost-effective and flexible.

### 3.2.1 Results from the data collection process

While executing the measures' inventory exercise, desk research activities and interviews have simultaneously dedicated attention to factors influencing the implementation and effectiveness of policies and measures (both + and -). We discuss elements that could be identified by means of both the interviews and otherwise through broad desk research (the latter refers to all information that has been registered in the database).

#### 3.2.1.1 Expert interviews – strategic organizations and institutions

From the proceedings of the interviews, we learned that the experts had difficulties to provide information on factors influencing individual measures. Interviewees (of different regional seas) listed however a set of factors that were assumed to facilitate or hamper good implementation of policy actions across the sea basin. The description of these factors is only at aggregate regional seas level, as the interviewed experts were generally familiar with the strategic objectives measures instead of the field implementation of specific measures. It is however interesting to observe that the outcome of different interviews often lead to the same success factors.

Several interviews in different regional seas lead to public acceptability of measures as an important enabling factor. Moreover it appears that public acceptance is generally associated with public or stakeholder participation and awareness raising efforts on the particular topic or domain. A significant number of experts (Baltic Sea, North Sea and Black Sea) also stated that a strong institutional framework and legislative conditions are essential for a successful implementation of measures. Finally, low costs, effective use of resources and the optimal scale of implementation are assumed to contribute to the effectiveness of policy actions.

In interviews, some factors negatively influencing the results and implementation of measures have been identified. It appears that in the interviews the power of lobby groups is mentioned as a serious threat to some proposed actions. For all regional seas it has also been argued that monitoring, (lack of) control and enforcement hinders the success of measures. Measures with serious (negative) impacts on key economic sectors will also experience difficulties in implementation. This could be broadened to the evaluation of the distributional impact of the policy action.

The role of the double dividend hypothesis was discussed with some stakeholders. Here, the main suggestion is that a “weak” double dividend is likely to apply and that the most welfare efficient measures would be to reduce distortionary labour taxes rather than hypothecating revenues for use in environmental protection.

Other issues include the risk of “pollution havens” in the existence of differential taxation in ports – implying that there is the potential risk of increased trade with neighboring ports with lower environmental standards. This may not lead to overall environmental improvement, particularly in the case where ecosystem thresholds exist. This suggests the need for cooperative action across borders.

Experts note the relatively limited experience with economic instruments for marine policy. The case studies will help build the knowledge base in this area.

### 3.2.1.2 Desk research – elements in the database

More insights in enabling and / or limiting factors have been identified for around 50 measures in the inventory. For these measures, we have performed a review exercise of success and limiting factors linked with the different types of measures. This assessment can help to discover whether ‘similar’ measures are assumed to be facilitated or hindered by the same factors. The key findings are grouped for the four main groups in our typology of measures.

These factors are briefly described by group, however it is of note that these factors are not exclusively related to one or another type of measure.

#### *Economic instruments*

Within the category of economic measures, the assessment has been further differentiated for the 4 considered subgroups: fee-based measures, trading systems, subsidies and compensation and liability mechanisms.

For the *fee-based measures*, adequate **fee-levels** are deemed essential for effective policies. The fee must be installed at a level that steers behavior appropriately (or raises funds) e.g plastic bag levy or a fishery by-catch levy. The latter must be high enough to provide an individual incentive for avoiding by-catch. Moreover, if the option is considered to foresee higher (evolving) fee levels over time, it would allow to integrate dynamic efficiency into the instrument (e.g. NOx-tax and fund in Norway). The **implementation scale** can also play a decisive role in the effectiveness of policy measures. Kågeson<sup>73</sup> (2009) for example describes that environmentally differentiated en-route charges or differentiated port or fairway dues should be run for the whole Baltic sea basin (Baltic) and preferably extended to North Sea ports to increase efficiency. When the scale of implementation is too small, potential side effects of installation of the fees can be that actors targeted by the fee are choosing for alternative options to avoid costs (targeting nearby ports, illegal aggregate trading when a country does not have the tax). Finally, fee-based systems generally suffer from lower **political acceptability** than e.g. subsidies. The same problem occurs for acceptance by industry or key economic sectors (legal challenges) if revenues are not recycled to the industry.

For *trading systems* (nutrient emission trading, voluntary biddings, ITQ's), it is pointed out that the **scale of implementation** is very important. In general, cost-effectiveness can be increased with a larger number of participants. The importance of the **design** of the

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<sup>73</sup> Kågeson, P. (2009). Market-based instruments for NOx abatement in the Baltic Sea

trading system and a **well-functioning administrative (support) system** is key for the success of the measure. For (decentralized) nutrient emissions trading, the government could define exchange rates for emission permits of measures and regions (relative value of abatement options e.g. permits in certain more sensitive areas may need to be given greater weight than permits for less sensitive areas).<sup>74</sup> For trading systems in fisheries (ITQ's), it is also good practice to provide opportunities for new entrants and avoid excessive consolidation of shares. The (initial) allocation is generally the driving principle and the most contentious issue in the development of a system (e.g. catch share system for ITQ's). Fishermen must be convinced that this allocation is fair and a true picture of their historic performance in order to make the system work.

*Subsidies* can prove ineffective when the **level** is not sufficient to compensate for example for increased (operational) costs, e.g. for the installation of after treatment technologies in ships. Similar remarks can be attributed to agri-environmental schemes where uptake from farmers appears to be limited when new practices are uncertain to be cost-effective (for individual farmers). Moreover, necessary advisory services for new farming practices are sometimes lacking or poorly installed. Subsidies are often also a very **costly instrument**.

For *liability and compensation regimes*, a properly designed **framework** and clear guidance for participants are necessary conditions in order to build and manage a successful tool. In other words, the key element in the design and implementation of such a system would be to limit uncertainty for participants. The system must therefore be supported by independent regulation and effective enforcement. Compensation regimes (and banking) are installed for biodiversity objectives outside the EU but currently regulation in the EU is lacking in order to manage such systems<sup>75</sup>. As briefly described in the previous paragraph, this type of legislation must be accompanied with sufficient enforcement activities of compensation requirements, because this helps stimulating the demand for offsets.

#### *Command-and-control instruments (CAC)*

In the category of command-and-control measures, effective enforcement and interest of stakeholders are indicated as important success factors. **Stakeholder's involvement and acceptance** is for example vital when implementing marine spatial planning from an ecosystem perspective. A transparent and open process towards such a planning might oppose the objections generally raised when rights or uses are limited. The same remark is valid for the measures restricting or prohibiting certain fishing techniques in order to protect biodiversity (by-catch, coral reefs, ...) or when designating national fishing zones (distance, sufficient stocks). Fishermen's acceptance and involvement can be regarded as the best remedy against illegal fishing activities.

Effective **enforcement** is a prerequisite for the effectiveness of (certain) CAC-measures. This is definitely the case when practices, activities or products are banned or prohibited (e.g. destructive fishing gear, phosphates in detergents, temporary closures of fishing areas).

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<sup>74</sup> For more details on nutrient emissions trading and nutrient reduction options, please see Elofsson, K. (2010). Baltic-wide and Swedish Nutrient Reduction Targets. An Evaluation of Cost-effective Strategies.

<sup>75</sup> Eftic, IEEP et al. (2010). The use of market-based instruments for biodiversity protection - the case of habitat banking - Technical report

It is also pointed out that some measures need to be implemented at a **minimum scale** to lead to positive results. Examples are the regulation of phosphates in detergents or the designation of a (NOx) emission control area.

As has been the case in earlier paragraphs, limiting factors are logically closely related to the described (absence of) success factors. In addition, it has been detected for certain specific measures that the **absence of clear standards or physical facilities** is likely to hamper target achievement of the considered measures. In order to prevent ferries from discharging sanitary water at sea, port facilities are a precondition. This can also be mentioned for manure standards that are essential to enforce regulation on N- or P-inputs on the field. Finally, the discussion can also be broadened to the presence of skilled staff (for enforcement or appropriate design of the measure) and sufficient (financial) resources.

#### *Social instruments*

In this category, we could only detect enabling factors for a small set of measures. It is of note however that for most of these measures, **awareness (raising) or changing the attitude** of stakeholders is perceived as an important enabling factor. This is for example the case for eco-labeling or social measures opposing litter problems (beach cleaning programs and actions to mitigate impacts of lost and abandoned fishing gear). The prerequisite for effective awareness raising is to ensure that stakeholders perfectly understand the specific problem being encountered so that actions can be appropriately targeted. This condition is also important for eco-labeling as a policy measure as it is recognized that the (current) multiplicity of labels (in all domains) threatens the transparency and thus effectiveness of labels. In addition, **stakeholder acceptance** is considered as an essential element for the success of these measures.

The assessment of inventory data learns that social measures rarely stand alone and are often implemented in **combination with other measures**. It is for example suggested to support (awareness) programs to mitigate impact of lost and abandoned fishing gear or the implementation of coastal area management programs with innovative economic incentives or compensations. The promotion of beach cleaning programs (and contiguous processing of waste) is assumed to be facilitated when such programs are integrated into national waste collection schemes.

**Costs and available budgets** appear to be major limiting factors for effective implementation of social measures. Regarding eco-labeling, costs must be borne by applicants, but also for specific ad hoc programs (beach cleaning, coastal area management programs), sufficient funding for actions appears to be a barrier to implementation. For some measures (e.g. prevention of abandoned and lost fishing gear) the wider policy or regulatory framework (international legislation or national waste systems) is well-established but implementation or enforcement seems to be poor.

#### *Technical, technological or research-oriented measures*

For a number of technical measures, it is assumed that there is **cooperation between countries** (e.g. EU-level or regional seas level). The introduction of a maritime surveillance system (accidents, but also oil or pollution prevention from shipping) is thought to be more effective when all countries along the sea basin are participating in the system. **Cooperation between stakeholders** also appears to be essential for some of the measures in this category, for example in combating nutrient inputs from the agricultural sector (agricultural forum, cooperation for biogas production, ...). Specifically

for technology inspired measures like anaerobic digestion of manure (biogas), such cooperation is often a necessary condition (best practices dissemination, cost sharing). In the case of establishing port reception facilities for example, low cooperation between authorities and shipping industry has been regarded as a factor leading to little progress in this field.

Similarly to the category of social measures, some technical measures could be implemented more successfully if accompanied by other **specific incentives**. Practical experience with some fisheries management systems (effort-based) has shown that the incentive to allow increased efforts (more days) can facilitate the introduction of more selective gears and sustainable fisheries.<sup>76</sup> Alternatively it is argued that prevention of abandoned and lost fishing gear and pollution control or abatement could be stimulated by (innovative) economic incentives (an example may be that of subsidies for more selective gear or financial incentives to return nets to shore).

The most important limiting factor appears to be related to the **uncertainty** and the **lack of public acceptance** (odor biogas installations). Uncertainty is for example related to the profitability (~investments) or financial outcome for stakeholders. In some fisheries sorting grids as selective gear are unacceptable as it leads to insufficient income, even if the number of fishing days would be unlimited. For biogas installations, the uncertainty relates to the market and prices for biogas and heat. Moreover, these category of measures (often innovative) are confronted with uncertainty of the results of the measures. Additional research and knowledge building will then be a vital factor in order to steer the installation or implementation of some measures (for example knowledge on effectiveness of seabed restoration techniques).

### 3.2.2

#### Summary overview of key success and limiting factors

We can summarise the key success and limiting factors as shown in the following Table. Various institutional factors arise that may lead to success or limitation of the implementation of the measures – notably in terms of the pre-existing legislative framework. It is important to note that any one limiting factor may significantly impact on the effectiveness of the measure to lead to the meeting of Good Environmental Status.

The **capacity to implement and enforce measures** is generally recognised as an important factor in determining the success of a policy instrument. Capacity building measures (e.g. training) have been used to facilitate the creation of capacity – but rapid staff turnover may present a major threat to this. Staff retention through appropriate incentives is important. Examples in the marine environment may include the need for adequate staff numbers to enforce Marine Protected Areas, which may be the subject of poaching.

**Clear departmental responsibilities** are key to ensuring effective implementation of a range of policy instruments. Conflicts between government departments limit the effective implementation of measures as the needs of various departments (e.g. transport ministries, finance ministries and environment ministries) restrict the strength of measures. This is likely to be particularly important in the management of the marine

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<sup>76</sup> Brochure on IMPSEL-project (2007). IMPLementation of more SElective and sustainable fisheries. Project funded by the Danish Ministry of Food, Agriculture and Fisheries.

environment because of the multiple uses of the seas and coastal areas. This may imply the need for coordination with e.g. defense, energy, tourism and fisheries on top of the ministries usually involved in environmental policy.

The need for an **effective legal framework** to ensure e.g. fines are enforced is important. If the legal basis for economic instruments does not exist, this is a critical factor – as it can take significant lengths of time to pass appropriate legislation. Another example is the potential problem to identify legal responsibility and allocating liability limits the cases where MBIs could potentially be the best approach in this situation. The lack of property rights or allocation of temporary rights for the use of the seas poses a threat to the successful implementation of policies to improve the marine environment. Preventing multiple users from accessing resources is clearly harder to enforce than the case where there is one land-owner. There is also the need for international treaties for certain policies to work – implying costly and potentially lengthy negotiations. Examples of sound international policy and regulatory regimes may include e.g. MARPOL Annex V, though here lessons can be learnt in terms of the implementation and enforcement of regimes.

The **appropriate scale** of technological measures may assist their cost-effectiveness – as Member States can share the high costs of e.g. disaster management, surveillance activities or some monitoring systems. The **need for international cooperation in monitoring and enforcement** in implementing policies to meet the requirements of the MSFD is clear. Large scale implementation often involves economies of scale and the potential to use more advanced technology. Common response mechanisms exist in certain marine contexts, e.g. in dealing with oil spills, and it is suggested that further cooperation on other marine pollution issues would be merited.

**Common systems on a broader scale** can be indispensable for economic instruments in order to be effective. Lessons could be drawn from previous work on the pollution haven hypothesis – i.e. there is a risk of a race to the bottom in environmental regulation to capture economic benefits. This may be particularly true for instruments targeting shipping. The use of ports and differential taxation of ships entering certain ports is a case in point. IFREMER (2004) indicates that few ships have Sweden as destination, which results in a situation where the differentiated fairway due has little results. Inter-port competition can make regulation at national level a minimum – indeed with improving land based transport networks such regulation may work best at a larger scale.

**Strong design of measures** includes the **minimisation of administrative burdens** which may otherwise lead to excess compliance costs. The theory behind economic instruments highlights the need for the **appropriate setting of the level of charge or the number of permits** to be issued in the case of tradable permits. There is also the need to consider ancillary impacts of the policies on other policy objectives – both in terms of other objectives of the MSFD and wider environmental and economic policy – these direct and indirect effects may need mitigation if they are negative, so policy modelling is needed. **Ensuring stakeholder engagement and acceptance** is essential for the implementation of measures where enforcement is likely to be difficult – this was noted as being important in terms of the acceptance of the mechanism for allocating ITQs for fisheries in Denmark, but is also true of all other marine policy. The main difficulty in the

marine contexts in doing this may be the variety of stakeholders to be engaged – which may be more extensive than similar activities for land based pollution regulation,

The potential for “win-win” measures can be enhanced by a number of factors. **Lead times** on implementation – i.e. giving adequate prior notice to industry of policy measures - are important to enable effective implementation of policy at lower cost to industry. The provision of information to industry at an early stage facilitates R & D and early internalisation of changes in e.g. pollution taxes into decision making. This applies to most measures, be they marine based or not. **Recycling revenues** may also assist in effective implementation – providing the basis for mitigating environmental damage and/or providing compensation for negative distributional effects – however, these likely lead to lower welfare gains than would be the case if the revenues were used to reduce distortionary taxes. **Flexibility** is enhanced by providing actors with the potential to respond to policy in ways that are most cost-effective. This includes the use of permits or other economic instruments which give appropriate incentives.

For social and decentralised measures, key success factors include ensuring comprehension of measures by society. This would include penetration of ecolabelling schemes and measures to enhance awareness. The marine environment is less well known than the terrestrial system, so particular effort may be needed to show, e.g. the impact of invasive species or the effects on sea grass of pollution. The need here is to communicate to all potential users, including those from outside the country in whose territorial waters the measures are intended to impact.

**Combinations of measures** are likely to lead to more cost-effective outcomes. Linkage between more traditional command and control instruments and the more innovative social and technological instruments will assist in ensuring effective outcomes. This is likely to be particularly true in the implementation of the MSFD, because of the competing uses of the seas. Of particular importance may be awareness raising. The need for understanding of the risks posed by invasive species from ballast waters is an example – measures to restrict the discharge of ballast waters in regional seas are likely to be difficult to implement without education on this.

The appropriate design of measures is certainly key – in terms of setting charges, permit levels and setting standards. These should be done based on best knowledge, with the setting of charges/permit levels being based on the best available modelling. This alone, however, will not guarantee success towards Good Environmental Status.

There are a number of factors that enable and limit the application of policy instruments to achieve Good Environmental Status. Based on a literature review and interviews we have identified a number of these. Certain actions may be taken in advance of implementation – notably the preparation of an appropriate legislative and institutional framework and capacity building. Giving stakeholders “buy-in” also facilitates the acceptability of the measures. Further work will be done in detailed case studies to assess these factors.

Table 13 : Key Success and Limiting Factors for Policy Instruments, with particular focus on application in marine areas

	<b>Success factors</b>	<b>Limiting Factors</b>
<b>Economic instruments</b>	<b>Strong institutional framework</b>	<b>Institutional failure</b>
	capacity to implement measures, including sufficient staffing and training.	conflict between government departments – e.g. defense and environment objectives may not be aligned.
	clear departmental responsibilities likely to be particularly important in marine context, where there are competing policy objectives for a range of Government agencies and departments	lack of clear institutional framework may lead to significant difficulties. Potential lessons from ICZM.
	strong legal framework – which may include the need for international engagement.	weak legislative framework
		weak enforcement including lack of monitoring likely to be a particular issue in marine context, where costly and difficult. Can gain from additional use of technology – e.g. remote sensing.
	<b>Strong design</b>	<b>Weak design</b>
	appropriate administrative demands	excessive administrative burden
	modelling of direct and indirect effects to allow for mitigation. This is likely to be difficult in the marine context, because of the generally weak scientific base.	lack of consultation of key stakeholders and lack of political acceptability likely to be a major issue in the marine context, where there is open access and the need for self-regulation. Communication may need to be across sector and country boundaries to be effective.
	appropriate setting of rates of EIs and permit allocation mechanisms	
	<b>Potential for "win-win"</b>	<b>Equity issues</b>
	identification of options for cost savings for industrial sectors. This is likely to be more difficult in the marine context, because of significant asymmetric information.	negative distributional impact may be a particular concern, particularly for vulnerable coastal communities.
	flexibility through e.g. tradable permits, This is more difficult in marine context because of the need for spatial limitation to prevent damage. Flexibility needs to be weighed carefully against environmental effectiveness.	negative impact on key economic sectors – particularly those reliant on shipping and fisheries.
	lead time on implementation to allow adaptation is important in general for EIs, but may be particularly important for marine sectors with significant capital investments (e.g. windfarms).	
	measures to recycle revenues to reduce negative distributional impacts	

	<b>Success factors</b>	<b>Limiting Factors</b>
<b>Command and control mechanisms</b>	<b>Effective implementation</b>	<b>Weak implementation</b>
	lead time on implementation to allow adaptation may be particularly important for marine sectors with significant capital investments (e.g. wind farms)	lack of lead time on implementation
	strong stakeholder engagement and acceptance – which requires significant effort in the marine context	weak participation in design
	strong enforcement	absence of clear standards
	appropriate scale of action may vary from similar instruments in a land based context, because of the dispersion of pollution and the nature of the maritime transport sector	lack of monitoring capacity – may require use of innovative technology
<b>Social measures</b>	<b>Comprehension by society</b>	<b>Costs</b>
	changing attitudes and awareness raising	costs of ecolabelling
	effective controls for ecolabelling and information provision	insufficient funding for information actions
	<b>Combination with other measures</b>	<b>Weak implementation</b>
	linking to EIs and/or CAC may yield greater benefits than application in isolation – in the marine context the need for social measures of awareness raising likely needed to facilitate enforcement.	for certain instruments e.g. prevention of abandoned and lost fishing gear, implementation may be weak
	may take time to mainstream understanding of information measures	
<b>Technical, technological and research-oriented measures</b>	<b>Strong implementation</b>	<b>Uncertainty over impact</b>
	coverage of MS in monitoring arrangements – the need for international action on marine remote sensing and other monitoring is clear	uncertain impact on profitability or financial impact on stakeholders – there is likely significant asymmetries in information for marine industry and government. Further cooperation needed.
	cooperation between stakeholders – needed to help research meet the needs of MSFD stakeholders	
	<b>Combination with other measures:</b>	
	linking to EIs may yield greater benefits than application in isolation	



## 4 Case studies

For the measures which are applied in practice to the marine area, the set of criteria developed in chapter 2 is applied to 5 case studies representative of the different situations in the EU (different seas, different ecological and economic situations...). For each of these measures, the case study further describes key factors supporting or hampering the overall goals and good implementation of each measure. The description of the case studies in this text focuses on the evaluation of the measure and main influencing factors. The full description of each of the 5 case studies can be found in annex 1 to this study.

In agreement with the European Commission, the following case studies were considered representative of the different situations in the EU (different seas, different ecological and economic situations):

1. NO<sub>x</sub>-tax and NO<sub>x</sub> Fund (Norway)
2. Aggregate tax / Levy (UK)
3. No Special Fee system (Baltic Sea)
4. Temporary / real time closures (Scotland)
5. MPAs (Medes Islands)



## 4.1 Norwegian NOx tax and NOx Fund

### 4.1.1 Introduction: NOx tax and Business Fund

The NOx (nitrogen oxides) tax was implemented in order to fulfil Norway's commitment to the Gothenburg Protocol under the Convention on Long Range Transboundary Air Pollution. As of 1 January 2007, the Norwegian State introduced a tax per kilogram of emission of NOx on energy production delivery. The NOx tax covers energy producing units within a variety of sectors including the following: domestic shipping (including fisheries), aviation, railway operations, land-based activities and off-shore activities on the Norwegian Continental Shelf. The environmental tax targets NOx-emissions from larger units.<sup>77</sup> The tax is calculated on the basis of actual NOx emissions. If these are not known, it is calculated on the basis of a source-specific emission factor or (if both are not known) based on standard values. In 2007, the tax was NOK 15 per kilogram (+/- 1.95 €), in 2011 it is NOK 16.43 per kilogram (2.14 €).<sup>78</sup>

Several Norwegian business organisations (15) have entered into an environmental agreement with the Ministry of the Environment to be exempted from the tax (i.e. **the NOx Agreement**, notified and approved by ESA<sup>79</sup>). Instead of paying the entirety of the NOx tax to the Norwegian State, undertakings that are party to the NOx Agreement will pay a reduced contribution to the NOx Fund (earmarked for the implementation of emission reducing measures).<sup>80</sup> In return, these undertakings sign a participant agreement in order to fix rights and obligations towards the Fund.

### 4.1.2 Environmental problem and objective of the measure

NOx emissions have multiple and complex impacts<sup>81</sup>: creation of health-hazardous ground-level ozone, acidification (acid rain) and eutrophication.

The NOx tax or NOx scheme (including the tax exemption and the creation of the NOx Fund) can be considered as an innovative instrument as it targets NOx-emissions in sectors where abatement measures have not commonly been implemented, for example fisheries and (coastal) shipping. Shipping represents a significant share of NOx emissions of maritime states. The **environmental NOx tax** covers approximately 55% of Norway's domestic NOx emissions and was installed to encourage reductions in NOx-emissions from domestic activities that are included in Norway's emission inventory (Gothenburg Protocol obligation). The **tax exemption** (NOx scheme) was introduced in order to achieve a higher reduction in national emissions of NOx than would have been achieved by the mere application of the full tax rate.<sup>82</sup> Accordingly, affiliated enterprises to the first NOx-Agreement have to reduce their NOx emissions by 18,000 tonnes in the period 2008-2011.<sup>83</sup> Reduction targets for the new environmental agreement 2011-2017

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<sup>77</sup> Toll Customs (2011) Circular no. 14/2011 S. Excise duty on emissions of NOx 2011, available at

<http://www.toll.no/upload/aarsrundskriv/Engelske/2011%20Emissions%20of%20NOx.pdf>

<sup>78</sup> 1 NOK = 0.130163 EUR (October 2011)

<sup>79</sup> EFTA Surveillance Authority. The temporary tax exemption (and privately organised NOx Fund) is considered as state aid. As a party to the European Economic Area (agreement), Norway must notify state aid to the ESA.

<sup>80</sup> <http://www.nho.no/NOx/english>

<sup>81</sup> [www.zero.no/publikasjoner/biofuels-in-ships.pdf/at\\_download/file](http://www.zero.no/publikasjoner/biofuels-in-ships.pdf/at_download/file)

<sup>82</sup> EFTA Decision No: 144/11/COL.

<sup>83</sup> See <http://www.nho.no>

have been set at 16,000 tonnes. More than 90% of the emissions that were initially subject to the tax are now instead covered by the agreement and contribute to the Fund. Reduced NO<sub>x</sub>-emissions (lower nitrogen inputs) can contribute to lower human-induced eutrophication (GES 5). The transboundary nature of these inputs and the complex process of eutrophication requires modelling to assess the effect in time and space.

#### 4.1.3 **Measure: definition and context**

##### 4.1.3.1 **Legal background and implementation**

In order to improve the level of environmental protection and reduce NO<sub>x</sub>-emissions, the Norwegian Parliament endorsed a tax policy on emission of NO<sub>x</sub> to be applicable from January 1, 2007. The legal framework of the NO<sub>x</sub> tax contains an exemption clause for sources encompassed by environmental agreements with the State concerning the implementation of measures to reduce NO<sub>x</sub> in accordance with a predetermined environmental target. The NO<sub>x</sub> scheme is based on the conclusion of two agreements: the “NO<sub>x</sub> Agreement” and the “Participant Agreement” both laying down rights and obligations for the parties involved.<sup>84</sup>

##### 4.1.3.2 **Relation to other policy initiatives**

As mentioned earlier, the Norwegian NO<sub>x</sub> tax is one of the first economic instruments to include the shipping sector (not international) in a scheme inspired by the polluter pays principle. Existing instruments or measures are usually top down (regulation) which can bring about some technological innovation for (new) installations. Existing policy NO<sub>x</sub> emission standards for international shipping are set by the International Maritime Organisation (IMO). New regulations were introduced by the IMO in 2008 which strengthen somewhat the NO<sub>x</sub> requirements worldwide for all new ships built after January 2011. A problem in the context of the IMO NO<sub>x</sub> standards is that they only apply to new ships and the strict 2016 limits are solely for Emission Control Areas (ECAs). Ships tend to have a life of 25–35 years before being scrapped so the turnover of the fleet is slow.<sup>85</sup> Thus in order to not only limit the growth in ships’ NO<sub>x</sub> emissions, but actually to reduce them, there is a need to cut emissions from existing vessels and to speed up the introduction of efficient NO<sub>x</sub> abatement technologies in new ships built before 2016 (Kågeson, 2009).

#### 4.1.4 **Evaluation of the measure**

##### 4.1.4.1 **(Environmental) Effectiveness**

###### Goal achievement

The introduction of the NO<sub>x</sub> tax in Norway (Fund one year later) arose to better fulfil Norway’s commitment to cut NO<sub>x</sub>-emissions under the Gothenburg Protocol. Contrary to emissions of e.g. NMVOC or Sulphur dioxide, NO<sub>x</sub>-emissions (since base year 1990) have known a growing trend before 2000 while remaining at a high level the years after.<sup>86</sup>

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<sup>84</sup> For more information, see <http://www.nho.no/affiliation/category478.html>

<sup>85</sup> Air pollution from ships. Presentation by Christer Ågren, Air Pollution & Climate Secretariat. 29 November 2010

<sup>86</sup> Specific figures and evolution of emissions to be found at Statistics Norway [http://www.ssb.no/agassn\\_en/](http://www.ssb.no/agassn_en/)

The combined effect of the tax and the fund shows a decrease in absolute NO<sub>x</sub>-emissions as of 2008. At the time of the creation of the NO<sub>x</sub> fund, the Environmental Agreement between the Business Organisations and the Ministry of Environment agreed on absolute emission reduction targets over the period of the first agreement 2008-2010 (with implementations still partly allowed in 2011). The NO<sub>x</sub> Fund indicates that they can document that the **emission reduction obligations** for the years 2007-2010 laid down in the Environmental Agreement on NO<sub>x</sub> (i.e. the new figure of 18,000 tonnes) **have been met**.<sup>87</sup> The Norwegian Climate and Pollution Agency has confirmed that the business organisations have complied with their emission reduction commitments in both 2008 and 2009.<sup>88</sup> The Environmental Agreements foresee both targets for the entire period and translates these to annual targets.

#### Additionality

The trend of Norwegian NO<sub>x</sub>-emissions<sup>86</sup> indicates that past policies have not led to a significant decrease in emissions. Unlike in most sectors, emissions in two key sectors (e.g. shipping, oil and gas) have grown (2000 – 2005) and the NO<sub>x</sub> tax has been installed primarily to curb the upward trend in these sectors. At the time of the installation of the tax, it was assumed that the tax in itself would not suffice to reach the emission ceiling under the Gothenburg Protocol, because the tax rate would be too low (Kelly et al, 2009). At that time, the Government already suggested that it would be necessary to consider the introduction of a NO<sub>x</sub> tax in the context of compensations paid to certain affected industries.

One of the conditions of the EFTA Surveillance Authority (ESA) to define the State Aid as acceptable has been that the scheme should contribute at least indirectly to an improvement of the level of environmental protection and that the tax reduction and exemption does not undermine the general objective. The aim of the NO<sub>x</sub> tax is, by imposing a financial contribution proportionate to the pollution made, to encourage undertakings to take concrete measures to reduce NO<sub>x</sub> emissions. The possibility to be exempted from the NO<sub>x</sub> tax goes further as it encourages the undertakings to combine their financial resources in order to enable them to implement measures which on their own they could less easily afford, thus achieving a direct and long term reduction in NO<sub>x</sub> emissions. The NO<sub>x</sub> agreement entails a *temporary* exemption of the NO<sub>x</sub> tax. Individual undertakings still have an incentive to consider measures for their own situation in the longer run, in order to lower or avoid future tax payments.

#### Effectiveness in relation to GES (MSFD) and side-effects

Atmospheric deposition is an important pathway for nitrogen to the sea. Emissions of nitrogen oxides contribute to nitrogen inputs to the marine environment. The portion of atmospheric inputs<sup>89</sup> (i.e. deposition) of nitrogen from land based sources, such as traffic and power plants, and sea based sources, such as shipping, into the OSPAR maritime area accounted for one third of the total nitrogen inputs in the period 1990 – 2001.

Nitrogen oxides can have a residence time of a few days making it possible to transport pollutants over distances above 1000 km. This specific feature makes it difficult to assess a policy measure in terms of reduced nitrogen inputs in the (own) marine environment.

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<sup>87</sup> P.c. Wenche Svellingen and Geir Høiby of the Business Sector's NO<sub>x</sub> Fund.

<sup>88</sup> EFTA Surveillance Authority Decision No: 144/11/COL, 19 May 2011.

<sup>89</sup> [http://qsr2010.ospar.org/media/assessments/p00310\\_PARCOM\\_Rec\\_88\\_2\\_and\\_89\\_4.pdf](http://qsr2010.ospar.org/media/assessments/p00310_PARCOM_Rec_88_2_and_89_4.pdf)

Deposition of nitrogen from long-range transport of nutrients is calculated using numerical models and measurements of the concentration in precipitation.<sup>90</sup> Deposition is usually greatest close to the source.

Next to reduced NO<sub>x</sub> emissions, it is important to note that some implemented measures supported by the NO<sub>x</sub> Fund can also result in reduced emissions from other pollutants or climate gases. The highest side-benefits are achieved by conversion to gas or new building. LNG (Liquid Natural Gas) gives a 90% NO<sub>x</sub> reduction and has a beneficial effect on other emissions: reducing CO<sub>2</sub> with 20% and low emissions of sulphur and particulates.

#### 4.1.4.2

##### Information on costs and benefits

###### Costs and benefits of the instrument

Costs of a policy instrument must be identified for the various parties involved. Implementation costs or direct costs (usually administrative costs for authorities) are distinguished from indirect costs including the associated costs for sectors or target groups (compliance costs). Further insights on costs are described for the situation of the isolated NO<sub>x</sub> tax and the NO<sub>x</sub> scheme respectively.

###### *NO<sub>x</sub> tax*

The **Government** installed the tax instrument in 2007 and bears the administrative costs for the design, the operation and the control of the tax scheme. Administration and implementation costs for the Norwegian government could not be identified for the NO<sub>x</sub> tax and Fund. When the tax on NO<sub>x</sub> emissions was introduced in 2007, annual extra administrative costs for the Governmental bodies having new responsibilities were estimated at a total of 9 million NOK (about 12 full time equivalents). It is of note that these figures represent 4 government agencies (tax and customs, Pollution Control Authority, Maritime Directorate and the Petroleum Directorate), making it impossible to isolate the impact of the NO<sub>x</sub> scheme.<sup>91</sup> The legal framework for the NO<sub>x</sub> tax is covered by existing regulations on special taxes. It is assumed that this existing framework limits the administrative costs in operation and control.

Indirect **costs for enterprises** in 2007 were primarily tax payments at a rate of 15 NOK per kg NO<sub>x</sub> (+/- 1.8 € per kg NO<sub>x</sub>). This has been the main cost for companies as it is argued that only a limited number of investments in abatement technology have been triggered by this tax considering the expected but delayed setup of a compensation regime (cfr supra). It is argued that this tax can't be passed on to final customers as most of the enterprises liable to the tax act in an international context. In the current situation (i.e. after introduction of the NO<sub>x</sub>-scheme in 2008), less than 10% of the undertakings are solely liable to tax. Nevertheless, enterprises still need to report emissions periodically (per trimester) to the Government. For ships, 2 hours per ship per reporting would be a rough estimate<sup>92</sup>. Some companies with many ships tend to automate this reporting (IT systems) saving both time and money in the longer run. For larger companies with complex industrial structures, the NO<sub>x</sub>-reporting is usually part of their emissions report

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<sup>90</sup> <http://www.environment.no/Topics/Marine-and-inland-waters/Eutrophication/Eutrophication/Inputs-to-coastal-waters/>

<sup>91</sup> Personal communication Eli Marie Åsen, Ministry of Environment

<sup>92</sup> Information on reporting provided by Geir Høybye from the Business Sector's NO<sub>x</sub> Fund.

and control-system that they have to report to the Government anyway, at least on a yearly basis.

*NOx scheme (NOx tax and tax exemption - Fund)*

After the introduction of the NOx Fund in 2008, the majority of NOx tax payers have decided to participate in the Fund and the operation and control of the NOx scheme is now controlled by the Business Sectors. **Authorities** have no direct implementation costs related to the Fund, except the closing of the Environmental Agreement between the Ministry of the Environment and industry organisations.<sup>93</sup> The annual loss in tax revenues is estimated at about NOK 1.39 billion (180 million euro).<sup>94</sup> As the Government was planning compensating measures for the tax, e.g. increasing grants for funding measures to reduce the NOx emissions of ships and fishing vessels, net impact on the State budget is reasonably lower. Kelly et al (2009) stated net tax revenue of NOK 520 million (67 million euro) accrued in 2007.

According to its statutes, **the Fund** shall be managed in accordance with the full cost principle (non-profit), i.e. all the financial means which the Fund receives will be utilised in accordance with its purpose of reducing NOx emissions in a cost-effective manner with the exception of necessary administrative costs. To date, in the first four years of operation of the Fund, the operational and administrative costs of running the Fund have been kept a low level (<2% of total contribution payments). The Fund claims that the interest returns from having out money (annual contribution payments) in the bank outweigh the costs of running the Fund (the latter including support services from Det Norske Veritas (DNV) and other services). It has been an intensive work (approximately one year) to set up a practical framework for the Fund. Start up costs in preparation for the Environmental Agreement were close to 0.3 million €. <sup>95</sup> Most of this was work by DNV to look into potential reductions of NOx from the shipping sector and how they could be developed over the period of the Agreement. These startup costs were pre-funded by the member organisations and later refunded from the Fund when the Agreement was in operation.

**Participants to the Fund** pay a contribution to the fund instead of the higher NOx tax. The rates of payment to the NOx Fund are NOK 11 per kilo NOx (1.29 €) for the offshore industry, and NOK 4 (0.47 €) for the other sectors (shipping, supply-vessels, fishing, industry, aviation, district heating etc.) instead of NOK 16.43 (2.14 €). This temporary exemption results in significant savings for enterprises liable to the tax (nearly 80% for non-offshore industry). Moreover, practically all contributions are recycled back to the businesses as grants for abatement measures. Support payments can cover up to 80% of the total costs (up to a maximum per kg NOx reduced) and are differentiated according to the type of the measure.<sup>96</sup> Considering that the offshore tends to have higher abatement costs (nature of its operations), cost-effective measures are first implemented in other sectors. This industry is thus financing an important share of the Fund while its

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<sup>93</sup> Specific costs have not been estimated, but can be regarded as marginal. Personal communication Eli Marie Åsen, Ministry of Environment

<sup>94</sup> For 2011, if the affiliates of the first agreement 2008-2010 participate in the second. See EFTA Surveillance Authority Decision No: 144/11/COL, 19 May 2011

<sup>95</sup> Information on the operational, design and setup costs of the Fund have been received from Geir Høiby from the Business Sector's NOx Fund.

<sup>96</sup> <http://www.nho.no/support-from-the-fund/category479.html>

potential to install cost-effective measures is low. Nevertheless, the offshore sector is paying still significantly less (40%) than when no tax exemption would exist providing an incentive to participate in the Fund.

### *Benefits*

Benefits of the policy instrument are directly connected to the reduction of NOx emissions. When benefits are looked at within the context of the Marine Strategy Framework Directive, these come as reduced nitrogen inputs into the North Sea area, with a potential positive effect on GES 5 (human-induced eutrophication). Overall benefits can also be considered in the wider context when looking at the harmful effects of nitrogen oxides pollution: health, acidification, .... From a policy perspective, it may be relevant to estimate the benefits of NOx reductions in terms of reduced external costs<sup>97</sup> of NOx emissions. Miola et al (2009), based on Holland and Watkiss (2002) mention marginal external costs of emissions for countries surrounding sea areas (EU seas). For the North Sea, this value was estimated at 3,100 € per tonne NOx (year 2000 prices). Hjelle (2006) mentions a shadow price<sup>98</sup> of 1.88 € per kg NOx for short sea shipping and coastal traffic. Benefits in 2011, based on estimated NOx reductions of +/- 21,000 tonnes then range from 40 to 65 million €. Assuming the total reductions from the two environmental agreement periods (18,000 and 16,000 tonnes), annual benefits could amount up to more than 100 million €.

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<sup>97</sup> External costs of activities (for example in relation to transport) are costs related to effects generated by that activity but not borne by the actor. See for example

[http://ec.europa.eu/transport/sustainable/2008\\_external\\_costs\\_en.htm](http://ec.europa.eu/transport/sustainable/2008_external_costs_en.htm)

<sup>98</sup> These prices have been based on estimated costs for Norway to fulfil the obligations of the Gothenburg protocol. For further reading, see Econ (2003). Eksterne marginale kostnader ved transport. Oslo, Econ Analyse.

### Cost-effectiveness

Cost-effectiveness plays a central role in both the design and the functioning of the system. Firstly, it can be argued that the NOx tax as an economic instrument stimulates cost-effectiveness / efficiency for emission abatement, by placing a direct cost on environmental damage. The collective commitment for emission reductions within the NOx fund allows freedom in the choice and priority of abatement options, as the initiative groups multiple sectors. The instrument thus includes by definition some elements to maximise cost-effectiveness.

Moreover, the notion of cost-effectiveness has been installed as the decision criterion to grant funding for abatement measures. With assistance from Det Norske Veritas (DNV), the board of the NOx Fund selects the most cost-effective NOx reduction projects<sup>99</sup>. The support rate can be differentiated by type of measure and the amount of support is limited per unit of NOx reduction. The cost-effectiveness of the NOx reduction measures has been estimated by the Business Sector's NOx Fund.<sup>100</sup> If the lifetime of measures are taken into consideration (from 5 – 30 years), the total average weighted cost for all measures with planned implementation by the end of 2011 is at NOK 15.30 (€ 1.90) per kg NOx. Granted support from the NOx Fund for these measures is at NOK 8.80 (€ 1.10) per kg NOx. The vast majority of the measures appear to have costs below the current NOx tax, while average cost increase with higher reduction levels.

Overall, it is estimated that approximately 80% of the reduction will come from maritime projects onboard vessels as they appear to be more cost-efficient.<sup>101</sup> One reason for costs at sea being lower is that the easiest and least expensive measures have already been taken ashore, but not yet at sea. The projects with the highest NOx reductions (most widely implemented) are selective catalytic reduction (SCR) (41%), followed by internal engine modifications and conversion into Liquid Natural Gas (LNG) fuel driven vessels (both +/- 18%).

### Financing

The combined instrument NOx tax and Fund provides a good financing mechanism for NOx abatement measures. Moreover, the costs of running the Fund are largely transferred to a (lean) non-profit business organisation creating the opportunity to implement the system without high costs for the public authority. Existing mechanisms to support investments in NOx abatement measures run by public bodies were terminated after the conclusion of the Environmental Agreement.<sup>102</sup> The NOx Fund has about 2% administrative costs covering own expenses for administration and purchased services (mainly DNV). Practically all contributions to the Fund go back to support for NOx reducing resulting in a nearly zero sum game for industry.

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<sup>99</sup> <http://www.airclim.org/acidnews/2010/AN1-10.php#1>

<sup>100</sup> Personal communication NOx Fund. See also 2010 annual report of the Fund.

<sup>101</sup> <http://www.airclim.org/acidnews/2010/AN1-10.php#1>

<sup>102</sup> Personal communication with Eli Marie Åsen, Norwegian Ministry of Environment.

#### 4.1.4.3 Suitability - Fit for use (context) and feasibility

The model combining the tax and the Fund is unique to Norway.<sup>103</sup> The tax is one of the first instruments that for example addresses NOx emissions from the domestic shipping and fishing sector making it suitable for countries with important coastal traffic and fisheries. In Norway, there is also good knowledge on the contribution of different sectors or sources in total NOx emissions demonstrating the necessity of a policy instrument targeting certain sectors. The presence of (strong) business organisations serves as a precondition for the scheme in order to run the operation of the Fund and to fulfil the targets of the collective.

When reduction of nitrogen inputs to the sea environment are the primary target, it should be considered if other available measures, such as the construction of wastewater treatment facilities, wetlands management or improved agricultural practices are implemented at a satisfactory level. It is likely that (some of) these measures can achieve equal environmental results at lower costs.

Taxation instruments are most easy to implement at the national scale. While efficiency may increase by implementing the scheme in an international setting (the Baltic Sea, or even including North Sea)<sup>104</sup>, some difficulties may arise. Internationally, it may be better to focus entirely on shipping emissions (and possibly in addition the off-shore sector). This could be done either by the introduction of a common scheme or by national tax regimes combined with contributions to a common NOx-Fund. The first alternative may turn out to be unacceptable for principal reasons as some countries constitutionally may find it difficult to allow a super-national body the right to tax activities that occur in its territory. In the second alternative each participating state would tax emissions from ships in its territorial waters and potentially its economic zone, but those exempt would pay a contribution to a common cause. The difficulty in the latter case may be to identify an international body that can take charge of the Fund. One possibility might be the European Community Shipowners' Association (ECSA), another the European Maritime Safety Agency (EMSA) or (in the case of the Baltic Sea) HELCOM.

#### 4.1.4.4 Social, legal and institutional context

Norway was one of the first countries to apply environmental taxes with a strong emphasis on efficiency in environmental policy and a continuous concern with competitiveness. The NOx scheme has been developed in order to provide efficient, environmentally oriented transformation without excessively burdening Norwegian industry.

The Norwegian State could rely on past experiences (e.g. CO<sub>2</sub>-tax) to set up the NOx tax. The instrument has first been announced in 2005 and was introduced 1<sup>st</sup> of January 2007. The competent authority (and its responsibilities) is clearly defined in the Storting Resolution. The implementation of the instrument is supported by clear documentation on the provisions and the scope of the policy instrument. Institutional deficiencies (e.g. accreditation of actors that need to verify emission reductions, procedures to define and approve emission factors, ...) will hamper the success and functioning of the system.

Both the Environmental Agreement and the Participant Agreement (basis of the Fund) provide specific provisions for control and possibilities to respond in case of possible violations, allowing effective control. **The Business Sector's NOx Fund** can impose

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<sup>103</sup> [http://www.nortrade.com/index.php?cmd=show\\_article&id=609](http://www.nortrade.com/index.php?cmd=show_article&id=609)

<sup>104</sup> Personal communication Per Kågeson.

finances in order to ensure adequate pressure with regard to fulfilment of commitments from enterprises, even before violations are determined. In case of violations, the NOx Fund may revoke an enterprise's participant certificate. **The Climate and Pollution Agency** reviews the annual reports and status reports and checks compliance with the reduction obligations for the specified periods. If the Climate and Pollution Agency finds that the participating undertakings have fulfilled less than 90%<sup>105</sup> of their annual reduction obligation before the deadline, a tax obligation will arise for the relevant calendar year.<sup>106</sup> The NOx scheme relies on a strict reporting system. Effective control within the system is ensured because support to measures is only paid after implementation and documentation of the measure – based on actual NOx reductions and costs. The Fund is assisted by a third party (DNV) to control real emissions. The verifications are done based on a self-declaration form submitted by the enterprises. Measurements thereto must be carried out by an accredited firm or a competent party approved by the Norwegian Maritime Directorate.

New policy initiatives often face opposition from different angles. Acceptance generally goes together with the distribution of the cost burden. After the introduction of the NOx tax in 2007, fishing industry opposed to the isolated introduction of the tax. Economic compensations (e.g. through the Environmental Agreement) had been announced but were not present from the beginning.<sup>107</sup>

Like for all environmental taxes inspired by the polluter pays principle, the main obstacle to institute the tax is often the power of polluters – and their threat of relocating or going out of business (Stern et al, 2000). Revenue recycling within the group of polluters may increase the acceptance of the policy. The NOx Fund may be considered as an unconventional example of Refunding of Emission Payments (REP), as it is a combination of a tax exemption and refunding of contributions to the Fund.<sup>108</sup> It is a price-type instrument where the regulator does not want to place the full cost burden on the polluters.

The introduction of the NOx Fund has been widely accepted by the different sectors affected by the NOx tax in Norway, as more than 90% of all registered enterprises subject to the tax and about 95% of taxable emissions have endorsed the Environmental Agreement, including e.g. oil and gas industry. Oil and gas industry chooses to join the Fund rather than pay tax as it is their belief that cost efficiency for other emission sources is much higher compared to for example for (their) offshore installations.<sup>109</sup>

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<sup>105</sup> 100% in the last year 2017

<sup>106</sup> This payment obligation means that if the Business Organisations fulfil 60% of the annual reduction obligation, the taxable source shall pay 40% of the ordinary NOx tax.

<sup>107</sup> <http://www.akerseafoods.com/text.cfm?id=3-206&path=3.61>

<sup>108</sup> Sweden has installed a NOx tax for large combustion plants where revenue is recycled back based upon useful energy production. The Swedish experience has often been used as a good example of a (successful) REP system. See e.g. Stern et al (2009) or Kelly et al (2009).

<sup>109</sup>

<http://www.statoil.com/en/EnvironmentSociety/Sustainability/2007/Environment/Climate/CarbonCapture/AboutCCS/Pages/CO2andNOX.aspx>

#### 4.1.4.5 Flexibility and adaptability

The combined instrument of the NOx tax and Fund has the capacity to be both flexible and adaptive, due to the very nature of the instruments (tax and collective commitment) and the setup of the NOx-scheme.

The grouping of multiple and diverse sectors (with specific NOx abatement costs) allows businesses to opt for the most cost efficient solutions for the collective entity. The success of the cooperative effort (Fund) is however dependent on the fact whether sufficient NOx reducing measures are being implemented. Flexibility is therefore likely to be higher in the short run compared to the end of the Agreement period. According to the Participant Agreement, undertakings have the obligation to implement a measure if it is cost-effective<sup>110</sup>.

The NOx tax and Fund do include future developments or potential changes. In the second and ongoing Agreement, it is stipulated that the emission obligations from 2013 may be adjusted if it is considered necessary in order to meet Norway's emission obligations vis-à-vis the Gothenburg Protocol in 2020. The state can then initiate negotiations with the business organisations. Technological developments are by definition considered as the tax base are emission units. According to the Environmental Agreement the Fund may support only new technology ready for implementation, i.e. support to full-scale new solutions. Other funds or organisations are usually granting support to research, development and pilot installations, while it is of note that the Fund now dedicates a small budget to pilots.<sup>111</sup>

#### 4.1.4.6 Broader impacts: risks and opportunities

It is fairly reasonable to assume that the NOx tax would have an impact on the **competitiveness** of certain Norwegian sectors subject to the tax. The activities coming within the scope of the potential tax exemption are typically transport by ship or by plane, heavy engineering, or energy generation at an industrial scale in addition to oil and gas production. Such activities are generally subject to strong international competition. In sectors such as fish and fish products, oil and gas and industrial products such as paper, metals, and building materials, Norwegian undertakings are not in a position to independently set the prices of their products (price takers).

Next to the issue of competitiveness, technological **innovation** has also been a motivation for signing the NOx agreement and establishing the NOx fund<sup>112</sup>. The Fund can create opportunities to develop new, environmentally efficient solutions within e.g. shipping and to provide greater marketing opportunities for environmental technology solutions. The supplier industry for NOx abatement or low NOx emissions technologies is worth more than NOK 5 billion (649 million euro) in Norway and the NOx fund's support of NOK 1.8 billion (234 million euro) will trigger measures and activity therein. The Fund's

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<sup>110</sup> In this context, a measure is cost-effective if the reduction in NOx emissions resulting from the relevant measure and the value this has in the form of reduced NOx tax calculated over a three-year period, is sufficient enough to cover the corporate costs in relation to implementing said measure, including the enterprise's fee after it has received support from the Business Sector's NOx Fund, including losses in cases of reduced operations or temporary shutdown of operations and other costs resulting from the measure for the enterprise or others.

<sup>111</sup> Personal communication Henning Mohn, Det Norske Veritas.

<sup>112</sup> OLF Norwegian Oil Industry Association (2010). Environmental report. The environmental efforts of the oil and gas industry. Facts and trends.

administration estimates the overall employment effect in the supplier industry at 500 to 700 full-time equivalents for the years of the agreement period. Moen et al (2010) claim that the real winners of the NOx scheme are companies offering equipment of systems for NOx emissions abatement. They expect that more alike initiatives will be introduced in the future and assume that companies with green performance better than industrial average will be rewarded. OECD (2010) underlines that environmentally related taxes can provide significant incentives for innovation, as firms and consumers seek new, cleaner solutions in response to the price put on pollution. It is also argued however that political economy issues (lower tax rates or refunding mechanisms) can maintain the marginal incentive to abate but can weaken some of the incentives to innovate, especially innovation undertaken at the collective level. It is therefore assumed that the combination of the tax and the Fund will most likely not spur innovations and technological development but will have a positive impact on the wider and faster deployment of existing technologies (see for example ships on LNG).

One potential negative side-effect often raised in relation to NOx abatement is the resulting **higher fuel consumption** and **associated CO<sub>2</sub>-emissions**. Entec (2005) for example notes that internal engine modification to reduce NOx emission (delayed injection) might increase CO<sub>2</sub>-emissions though for the majority of technologies it was assumed that there was no impact on fuel consumption.

#### 4.1.5 Enabling and limiting factors

The scheme has now run for a few years and first experiences have lead to some interesting thoughts on the factors that could influence the success of the instrument. Success factors and potential pitfalls are further described and discussed in the next paragraphs.

##### 4.1.5.1 Strong design

The instrument has been introduced as an initiative to reduce pollution from larger NOx emission sources. When opting for a certain instrument, it is key to consider the desired behaviour of the target group and to select the measure that can steer their actions. When installing a tax, the **tax rate** needs to be high enough in order to justify investment in abatement technology. Where an isolated tax faces strong opposition (competitiveness, strong sector organisations, ...), compensation measures or **refunding** could be considered resulting in lower costs for polluters. The incentive effect of the NOx fund lies in both the *(temporary) exemption*<sup>113</sup> from paying the fiscal NOx tax and the possibility to receive *support* to implement measures. Even if firms are not granted support, the temporary (and partial) exemption lowers the cost of taxation when these were normally highest (i.e. at the beginning, when no measures have been installed yet). OECD (2010) recommends that tax rates should be relatively predictable to strengthen investment and abatement decisions. The level of the contribution to the Fund is set by the NOx Fund's Board and have been agreed with the business sectors.

The experiences with the Norwegian NOx scheme have shown that it could be advisable to establish the notion of **payment post implementation** in the instrument design. Support payments for measures are only granted after implementation and full documentation in order to ensure that the support goes to actual NOx reductions. This is

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<sup>113</sup> In other words, the presence of a credible NOx tax is a necessary condition for the success of the fund. Personal communication Henning Mohn, Det Norske Veritas.

an important element as the Business Sector's NOx Fund needs accreditation of the NOx reduction in order to be able to fulfil its own commitments to the Environmental Agreement (payments per unit of NOx reduction). It is important to note that the Fund provides a letter of guarantee (for financing institutions) for applicants that have been selected for support. The Fund believes it is essential to foresee sanctions (e.g. by reducing support) for enterprises not submitting documentation.

A potential pitfall for the success of the system could be the risk of granting an insufficient **level of support**. Support to measures must be large enough so that the enterprises are willing to take the risks and additional costs of implementing the measure. Based on the current experience of the Norwegian Business Sector's NOx Fund, it is indicated that a measure must be supported from the Fund with at least 50% of the implementation costs.

In Norway, oil and gas industry claims that experiences from the NOx fund (collective commitment) show that several elements of this fund model can serve as a good model for other purposes as well e.g. establishing a climate fund (OLF, 2010).

#### 4.1.5.2

##### Stakeholder commitment and cooperation

Private business organisations representing undertakings subject to the NOx tax are co-founders of the NOx Fund. Midttun (2009) states that industry federations are strong supporters of negotiated agreements (between **business and government**) as they believe these could be more efficient and effective means for achieving environmental and climate policy results than traditional taxation (governance efficiency). It is argued that the fact that industry has exceeded the requirements of the agreements is taken as a proof of this. The NOx scheme requires good understanding between industry associations and the authorities. The continuation of the scheme in Norway can possibly underline the assumed advantages of the said scheme where an isolated tax is not viable (competitiveness) or other regulation is difficult (different sectors). A fund managed by business may have advantages from the efficiency perspective due to built-in incentives for cost minimisation. Overall, flexible cooperation between the Fund and its partners resulted in a lean NOx Fund operation.

**Commitments from individual undertakings** are laid down in the Participant Agreement. Affiliated enterprises have to develop a measure plan<sup>114</sup> identifying possible NOx reducing measures within two years after affiliation. The NOx Fund is well aware that enterprises may not have any profitable or cost-effective measures at present for their enterprise. Nevertheless, the enterprise shall undertake a review to reveal potential NOx relevant measures. If cost-effective measures are selected for support by the Fund, the enterprise has the obligation to continue with the implementation thereof.

#### 4.1.5.3

##### Timing and policy certainty: introduction, anticipation of target group and eventual targets

The NOx tax was introduced to reduce Norway's emission of NOx as the national emissions were too high. According to the Fund<sup>115</sup>, the tax introduction should have been better timed and communicated to the target group. Preferably, economic instruments (especially taxes and charges) should be announced well in advance and should involve consultations with stakeholders. This will enable actors to take account of the instrument in their decisions and to react optimally to the changed conditions, thus improving overall efficiency.

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<sup>114</sup> <http://www.nho.no/affiliation/category478.html>

<sup>115</sup> Personal communication Wenche Svellingen, Business Sector's NOx Fund

It is also argued that the NOx tax alone would not have given the amount of NOx reductions needed to meet the obligations in the Gothenburg Protocol. This has been confirmed by some voices in fishing industry, stating that the introduction of the NOx tax without economic compensation is poor environmental policy. Besides the impact on margins of fisheries, this delayed introduction of the Fund most likely postponed the process of investing in environmental friendly technologies.

On the other hand, the effective implementation of the NOx tax did create the situation where the industry believes that the tax is a credible instrument and is there to stay. The tax exemption is as such regarded as a temporary situation and enterprises have the incentive to seek for reduction measures at the individual level as well.

#### 4.1.5.4

##### Good information and knowledge

Target groups are usually sceptical of environmentally related taxation, believing that it may simply be a tax grab or may not fully understand why the tax is raised. Strong communication and credible proponents of the tax can help to overcome these issues. Norway's communication is consistent on the objectives of the NOx tax (and scheme) referring to the country's obligation to the Gothenburg Protocol. The NOx Fund has organised multiple information meetings with active participation from all stakeholders. The Fund has a lot of direct contacts with participant enterprises through e-mails, telephones and meetings and has an extensive webpage with clear and complete information in English and Norwegian as foreign enterprises can also be subject to the tax and thus participate in the Fund.

The NOx Fund appears to have led to a high level of transparency and openness, for example in the shipping sector. Emissions and fuel consumption are reported periodically, where little or no data has been available in the past. Enterprises that have been granted support are published on the internet and information is accessible for competitors. The Fund's annual report shows emission reductions for individual undertakings and the time schedule for these projects.<sup>116</sup> The website also lists abatement technologies for all sectors participating in the Fund and their suppliers. There is a random order of the suppliers in the lists, in order to avoid favouring any particular technologies or suppliers. The document is dynamic which will be updated as new technologies reach the market. Since the market and the technologies are constantly developing, there may be additional systems in the market which we not yet have detected. Any updates from the suppliers to this memorandum are appreciated.<sup>117</sup> This transparency and information sharing can contribute to a more level playing field for enterprises.

Finally, it is important to underline the necessity of good knowledge on real emissions and emission reductions, referring to the presence of the third party (Det Norske Veritas) in the Norwegian example. The company offers its expertise for evaluating the reduction potential based upon the initial application of the enterprises and advises the NOx Fund Board on expected reductions and most promising proposals. After implementation, the installation needs to be checked by an accredited institution and the documentation then goes back to DNV in order to evaluate the effect of the measures. In their evaluation, they also address fuel consumption (past and projections) in order to assess real reductions.

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<sup>116</sup> See for example <http://www.nho.no/getfile.php/bilder/RootNY/NOX-fondet/NOX-fondets%20arsrapport%202010.pdf>

<sup>117</sup> <http://www.nho.no/technologies-and-suppliers/category515.html>

#### 4.1.5.5 Control and enforcement

The NOx tax and NOx fund defines strict reporting requirements for individual enterprises and the collective NOx fund. This reporting is needed in order to evaluate and monitor the different obligations and objectives. When obligations are not met, tax is still payable based on the actual emissions.

According to the NOx Fund, control of free riders in shipping from the Norwegian Customs and Excise was only in place in 2010, while it should have been there from the start. Today, ships need to present a valid NOx declaration (taxes paid or exempted) at every port call.<sup>118</sup> The intensive use of ship tracking systems (AIS) and strict port control now make it impossible to refrain from NOx obligations.

#### 4.1.6 Conclusion

The combination of the Norwegian tax and Fund is innovative in a number of ways. The economic instrument includes sectors where NOx abatement measures have not been widely implemented (shipping, fisheries) and undertakings pay according to the pollution they create. Experiences gained in Norway provide further insights on the factors contributing to the success of the instrument. The economic instrument of the NOx scheme relies on a *strong design* (increase acceptance through tax exemption, payment post implementation), a *participative approach* (agreement between industry and the authority) and good *knowledge and control* of both emissions and reductions.

**Suitability** of the NOx scheme has been illustrated in the Norwegian context, where coastal / short sea shipping and fisheries are a key contributor to NOx emissions. The Fund is managed by industry and requires strong Business Organisations and cooperation between sectors in order to fulfil the collective targets. Successful cooperation can be confirmed as a key success factor for the policy instrument, without ignoring one important driver for cooperation from the business side: lowering of the cost burden through the scheme. The cooperation between public government and business installs a double control of emission reductions with strict reporting requirements. Good knowledge and information on the tax base (real NOx emissions) is therefore crucial both for emitters and the authorities.

The scheme has installed cost-effectiveness as a decision criterion to grant support for abatement measures. The setup as a cooperative – business organised - effort combining sectors with different abatement curves has the possibility to maximise **efficiency**. A key element in the scheme is the cooperation between the State and industry where part of the administrative costs are transferred to the business sectors.

Now 4 years in operation, the reduction obligations of the Environmental Agreement - at the basis of the NOx Fund - have been met. The instrument has contributed to curb the upward emission trend in the sectors covered by the tax scheme and absolute emission reductions have been achieved (**effectiveness**). The impact of the isolated NOx tax can't be assessed as it has only run for one year in isolation and the market did not respond to the tax immediately counting on anticipated support measures. NOx emissions have complex impacts and benefits (e.g. reduced nitrogen inputs) are not readily traceable to the (own) marine environment. Impact on eutrophication (GES 5) is therefore not easy to relate to the instrument.

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<sup>118</sup> Personal communication Henning Mohn, Det Norske Veritas

Through the tax exemption, the NOx scheme can be considered as a taxation where revenues are recycled back to enterprises to lower the **cost burden** and increase the acceptance for the instrument. This design element integrates the competitiveness aspect of the target group, and can be particularly relevant where businesses operate in a highly competitive (international) setting and where increased costs can't be integrated in the selling price. From the government perspective, there is still some potential to renegotiate overall reduction targets (adaptability) though policy certainty should not be ignored (investment risks for companies).



## 4.2 Case study Aggregates Levy in the UK

### 4.2.1 Introduction: Aggregates Levy

The Aggregates Levy was introduced by the UK Government in 2002 as an environmental policy to reduce the impacts of aggregate extraction. The Levy was set at a fixed rate of £1.60 (€2.54<sup>119</sup>) per tonne (rising to £1.95 (€2.19) in 2008 and £2 (€2.33) per tonne in 2009) across all aggregate types regardless of the source or extraction method (Fullerton et al, 2010)<sup>120</sup>. Monies raised from the Levy were originally hypothecated back to the industry in the form of reduced National Insurance payments and a Sustainability Fund. The Levy is not a specifically marine-focussed policy but does have the potential to be used in other countries as a measure to work toward the MSFD. Aggregates are necessary for the construction industry, as well as for projects such as beach refurbishment, amongst others. The UK aggregate industry is represented by the Quarry Products Association (QPA), the British Aggregates Association (BAA), the Mineral Products Association (MPA) and British Marine Aggregate Producers' Association (BMAPA). The Levy raised between €393m (£247m) in 2002/3 to €503m (£400m) in 2008/9 (Fullerton et al, 2010), with the rise in part due to a rise in the rate of the Levy. Of this, marine aggregates contribute about 20% of the total, a proportion which remains fairly constant over the time period.

### 4.2.2 Environmental problem and objective of the measure

Aggregate extraction from the sea bed makes up around 20% of the aggregate extraction in England and Wales, but this can vary substantially by region. In 2006, 13.4Mt went to the UK construction sector, 6.7Mt went to export and 4.1 Mt went to beach nourishment (Highley et al 2007). In 2005 the public sector used 40% of aggregates in the UK, primarily for transport (EEA 2008). Marine extracted aggregates are mainly used for concrete (Sutton and Boyd, 2009).

Dredging the aggregates from the sea bed can cause a number of problems to the environment. Not only is the benthic ecosystem removed, causing habitat destruction and biodiversity loss, there can be wider issues with changes to surrounding habitats through sediment dispersion, and turbidity plumes (OSPAR 2009).

Marine extraction is controlled by the UK Government, the Crown Estate, which owns the sea bed in British waters, and the British Marine Aggregate Producers Association (BMAPA). Licences and permissions to extract are subject to environmental impact assessments which cover issues such as impacts of wave/erosion patterns, ecosystems, fisheries, water quality, navigation, archaeological sites and others (Gubbay, 2005) . However, some of the oldest permissions were granted before environmental monitoring requirements (MEPF 2009: 1).

In 2010 the area licensed for dredging was 1,291 km<sup>2</sup>, but only 105km<sup>2</sup> were dredged and 15.95 Mt extracted, shown in the following Table. 90% of dredging took place within 37.63km<sup>2</sup>, but only 6.83km<sup>2</sup> was subject to more than 1hr 15 mins dredging per year (BMAPA website). The area dredged is a tiny fraction of the UK's sea bed.

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<sup>119</sup> Note: the impact of the changing exchange rates is greater than the impact of the price rise. Exchange rates calculated at historic levels (eg. 2002, 2008 here). No attempt has been made to re-inflate to 2011 prices.

<sup>120</sup> Fullerton, D., Leicester, A. and S. Smith (2010) "Environmental Taxes". Chapter 5 in Mirrlees, J et al (2010) Dimensions of Tax Design: The Mirrlees Review. Oxford University Press, Oxford.

Table 14: UK marine extraction – area and quantity (source: BMAPA website 2011<sup>121</sup>)

	Area of seabed licensed for dredging (km <sup>2</sup> )	Area available to be worked (km <sup>2</sup> )	Area dredged (km <sup>2</sup> )	Quantity dredged (m tonnes)
1998	1,458		222.6	20.47
1999	1,455		220.3	23.68
2000	1,464		155.4	20.68
2001	1,408	972	150.6	22.76
2002	1,359	896	149.8	21.93
2003	1,264	890	143.8	22.23
2004	1,257	780	134.5	21.45
2005	1,179	596	137.6	21.09
2006	1,316	576	140.6	24.18
2007	1,344	556	135	23.09
2008	1278	570	138	21.24
2009	1,286	536	124	20.1
2010	1,291	552	105	15.95

Areas that are suitable for aggregate extraction are likely to be those where the sea bed is mainly gravel. Depending on local currents, this habitat can be an ecosystem that is used to large natural movements of the sea bed, and where the dominant species are capable of relatively swift recolonisation, hence the direct impacts of dredging may be relatively low. However, other locations may take longer to fully recover from even low intensity dredging.

Figures for the cost of marine aggregates are rare in the public domain and are likely to vary according to the quality and type of aggregate, where landed, and when, but Cooper et al (2011) use a value of €13.78 (£12) per tonne based on personal communication with the BMAPA. This gives a rough idea of the approximate scale of the cost impacts the Levy has on the industry. The Levy therefore adds around 17% to the cost of aggregates. In 2005, 68 million tonnes out of a total of 275 million tonnes produced came from recycled and secondary sources (EEA 2008). The UK has had one of the highest levels of recycled aggregate usage in the EU since before the Levy was introduced.

<sup>121</sup> [http://www.bmapa.org/issues\\_area01.php](http://www.bmapa.org/issues_area01.php)

## 4.2.3

### Measure: definition and context

#### 4.2.3.1

##### (Legal) background and implementation

In July 1997, the UK Government set up a review into the possibility of raising a charge on quarrying, at the same time as developing principles for green taxes (House of Commons, 2011). There was opposition at the time from industry groups but the Levy was introduced in 2002 at a level of €2.52 (£1.60) per tonne, applicable to all aggregates extracted in the UK or imported into the UK. The revenues from the Levy were to be hypothecated back to the industry in the form of a 0.1 percentage point reduction in National Insurance payments of the employers (i.e. a fall in the cost of employment) and a Sustainability Fund.

This Fund was set up “to promote alternatives to virgin aggregate and reduce the environmental impact of aggregate extraction” (House of Commons 2011:13). At first €46.6 (£29.3) million was available each year for the first two years of the Fund, distributed through a number of quasi autonomous non-government organisations (Quangos). Towards the end of the Fund, monies were allocated on a 3-year basis, allowing for more stability in the expenditures. The Fund has since run each year up to 2011 when it was discontinued as part of wider cuts. It seems that any surplus revenues from the Levy after the National Insurance rebate will be directed back to the central treasury.

The Levy was set at a level approximately based on results from a study which explored the social costs of land-based quarrying (London Economics 1999). There is no variation in the Levy for different types of extraction process, and so quarries or dredgers with a lower environmental or social cost pay the same rate as those with a higher impact.

The Aggregates Levy Sustainability Fund (ALSF) was introduced at the same time as the Levy. In 2007, approximately €44m (£30m) was available to the ALSF, of which around 10% went to the Marine ALSF. Research priorities were developed based on input from the main users – there was general agreement that increased knowledge in order to reduce risks and increase certainty for regulators, advisors and industry for the planning, assessment and management of marine aggregate operations was a priority for all groups’ decision making (BMAPA 2011 – pers comm. with M. Russell). In 2010 it was announced that the ALSF was to be discontinued due to budget reductions<sup>122</sup>.

By 2007 over 50 research projects had been funded, with half of funding going towards seabed resource mapping (Defra 2006). The work undertaken has wider benefits than just the marine aggregate sector – for example, the increased understanding of marine habitats, impacts and pressures has helped to develop better Marine Protected Areas (MPAs) and inform the assessment and management of other marine industries’ (BMAPA 2011 – pers comm with M. Russell). Projects funded by the ALSF can be searched for at <http://alsf.defra.gov.uk/>.

A 2011 study from Defra<sup>123</sup> found that in the 2008-2011 period the Fund had met its aims – some benefits were quantified, but not marine benefits. The quantified benefits of the fund were estimated to have a present value in 2010 of €227.3m (£195.1m), compared to an expenditure (in 2010 present value terms) of €23m (£20m) (Daykin, 2010).

The Levy is currently under challenge in the European Courts, with the industry group the British Aggregates Association (BAA) claiming that the Levy constitutes illegal state aid as the Levy is not charged on all aggregates. (some rock types are excluded based on

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<sup>122</sup> <http://archive.defra.gov.uk/environment/quality/land/aggregates/index.htm>

<sup>123</sup> Department for Environment, Food and Rural Affairs

their geological description). The BAA has won one appeal and a further judgment is pending.

#### 4.2.3.2 Relation to other policy initiatives

The Aggregates Levy has an aim of increasing recycling of aggregates. This is shared by the Landfill Tax, currently at €64.30/tonne (£56/tonne) and rising to €91.85/tonne (£80/tonne) by 2014. This means that any aggregates arising from construction activities or similar that may in the past have been disposed of are now considerably more attractive to be used as recycled aggregates. The Aggregates Levy of €2.33/tonne (£2/tonne) is small compared to the Landfill Tax and the industry suggests that the impacts of the Levy in this regard are negligible (Alston, 2011, pers comm).

Marine aggregate extraction is subject to a system of permissions and licences from the UK Government and the Crown Estate, which includes a research fund and environmental impact analysis of sites as well as monitoring of dredging activity. The Marine Mineral Guidance 1: Extraction by dredging from the English seabed (MMG1) states that dredging should aim to leave the seabed in a condition to enable recovery. In Wales, the Interim Marine Aggregates Dredging Policy (IMADP) includes consideration for repair and restoration if unanticipated harmful impacts occur (Cooper et al 2011).

From an international perspective, a number of other countries have an Aggregates Levy or similar, although not all of these countries have marine extraction. However, the UK has the highest level of Levy and the greatest revenues.

#### 4.2.4 Evaluation of the measure

##### 4.2.4.1 (Environmental) Effectiveness

No specific targets were set for the Levy, either in terms of changes in extraction, changes in environmental quality or recycling rates.

For the marine context, there are no specific studies looking at the impact of the Aggregates Levy. There are two questions that have to be addressed:

- *Has the Levy's impact on prices changed extraction behaviour?*
- *Has the Sustainability Fund led to improved environmental quality?*

The UK Government in 2005 assessed the Levy which found that “early indications suggest the aggregates levy has been effective in achieving its objectives” since primary aggregate sales were falling and production of recycled aggregate rose. (House of Commons 2011). However, this analysis did not look at wider or existing trends in recycled aggregate use or overall aggregate demand and seems less precise than other studies. The Levy does seem to be a key mover in increasing recycling of aggregates and in increasing the use of exempt materials sold as aggregate.

Specific benefits of the Fund would be through behaviour change created by the new knowledge, such as improving state-of-the-art monitoring or changing licensing criteria. Some benefits may also arise through the work of the wider Fund in promoting recycling.

In 2007 a report assessed the current state of knowledge about various aspects of marine dredging. This information was used to identify future research projects funded by the MALSF, including a number used in this case study, such as Austen et al (2009), Tillin et al. (2011). Therefore knowledge has increased, but it is not yet apparent how much this knowledge has led to actual changes in environmental quality. The licencing

framework allows relatively quick implementation of new information so such changes could be in place soon after research has been published.

The Levy does not operate alone within the sector. It can be seen to work alongside other policies and legislative frameworks. In the case of marine aggregates, it probably generates benefits in conjunction with the strong licensing regime since the knowledge generated by the Fund's research can be transferred into practice relatively directly and swiftly.

The key indicators in terms of Good Environmental Status (GES) relate to the descriptor "Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected." Determining the impact of the aggregates levy on marine extraction is difficult, particularly given the existence of licensing. If there were no other trends or pressures on the market for marine aggregates, such as a strong, growing construction sector, it would be reasonable to assume a rise in the price of aggregates would lead to a reduction in the quantity of aggregates dredged, and so a fall in environmental impacts. Based on simple partial equilibrium analysis, a reduction in demand for aggregates of between 0 to 7 percent could be attributed to the introduction of the levy, though other market drivers make evaluation of the impacts using market data difficult (see Annex for further details).

#### 4.2.4.2

##### Information on costs and benefits

###### Costs and benefits of the instrument

Direct costs of the instrument include the administrative costs to the producers and to the UK's Revenue and Custom's Authority (HMRC – Her Majesty's Revenue and Customs), the collecting body. The costs are mainly the extra paperwork and monitoring costs, of recording the extracted levels, calculating and claiming for exemptions, and so on. Start-up costs include developing and implementing new systems for administrators and data collection in firms. These are felt to be small, with setup costs of producers around 0.5p per tonne and ongoing costs of around 0.3 pence per tonne (House of Commons, 2011).

In terms of revenues from marine based aggregates it is possible to estimate these on the basis of taking the amounts extracted and multiplying by the levy applied for the various years. The results vary from nearly €36m (£32m) to nearly €53m (£47m) per year.

The benefits of reduced marine aggregate extraction have been evaluated in several studies, notably Austen et al (2009), Tillin et al. (2011) and Cooper et al (2011). The main impacts of marine aggregate extraction are the direct impacts of the removal of a layer of the sea-bed, leaving depressions and furrows and changing the make-up of the sediments on the sea bed. Also, if the dredger implements sediment screening<sup>124</sup>, sediment plumes from the ship can be damaging to a wider area (Barrio Froján et al 2011). There can also be social costs if cultural heritage is damaged (e.g. wrecks), costs to fishing activity if fish stocks are disturbed or spawning grounds disrupted, costs to tourism (if dive sites are affected) and possibly erosion patterns can be changed. However, as noted above, the UK aggregate extraction process is governed by a licensing programme that required Environmental Impact Assessment of the above. However, it remains that aggregate extraction means removal of habitats and the flora and fauna within the dredge zone.

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<sup>124</sup> This is where the ship filters out the smaller, sandy particles and keeps the desired sized gravel. The removed sediments are washed into the sea where they can settle well outside the licenced area, changing the composition of the seabed and affecting habitats and biodiversity.

Austen et al (2009) researched the overall social benefits of the Eastern English Channel's marine environment as a scoping study to estimate the impacts of aggregate extraction. One impact of dredging is that gas and climate regulation could be altered by between -€15,868 (-£14,139)/km<sup>2</sup> and +€9,867 (+£8,792)/km<sup>2</sup> – this is the amount of carbon sequestered by living organisms multiplied by the damage costs avoided –. Dredging changes the quantity of organisms in the area and so the amount of carbon sequestered. As this study is just a scoping study, results are preliminary and subject to a high degree of uncertainty. They also look at cognitive benefits (benefits to researchers, academics etc. from being able to study the areas) that may change by +€2.5m (+£2.2m) through the funds generated (including the Sustainability Fund). These positive effects may include research and development activities, the benefits to local higher education institutions, the public sector and education and training. The authors note that of the possible cognitive benefits, the only quantifiable benefit attributable to the aggregate industry was the research arising from the Fund (MEPF-ALSF, i.e. the Aggregates Levy Sustainability Fund).

Tillin et al. (2011) – also funded by the Sustainability Fund – found that the direct and indirect impacts of aggregate dredging are “likely to be not significant as they are minimised through management and mitigation measures”.

#### Cost-effectiveness

In terms of cost-effectiveness, the aggregates levy is revenue generating and, as revenues are used to reduce distortionary taxation, the net social effects are likely to be positive (however this depends on assumptions about the marginal cost of public funds). The administrative costs estimated do not seem excessive compared to the revenues raised. The difficulties in assessing the environmental benefit of the measure in terms of reduced marine aggregate extraction need to be noted.

The measure was originally designed to keep implementation costs low by using a flat rate levy rather than differentiating different extraction methods or by evaluating the specific environmental impact of a quarry/dredger.

#### 4.2.4.3

#### Suitability - Fit for use (context) and feasibility

In this section the suitability of the Aggregate Levy as a marine policy instrument will be explored. Conclusions reached are not therefore conclusions about the suitability of the overall UK Aggregate Levy.

The Levy was not set at a level based on social or environmental costs of marine extraction. In terms of implementation, the Levy was appropriate as it was aimed at keeping administrative and monitoring costs low – which is one reason for the single rate. The Levy's Sustainability Fund developed over the years, incorporating a wider set of research projects and longer-term projects. This adaptability means that its suitability can be seen to have improved over time. The scale seems suitable, since there is little opposition to the Fund from industry and a number of in-depth research projects have been funded. However, the fact it was considered unessential in the face of budget cuts suggests that the government felt that it was not necessary to continue with.

The Levy does not seem very suitable as a means of lowering the environmental impact of dredging by encouraging less dredging since the cost is passed on in full to consumers and the evidence suggests this has not greatly changed behaviour. However, the Sustainability Fund does seem to have been a suitable way of generating benefits from

research funded by the industry which are likely to lead to environmental quality improving in the future, even if the Fund no longer exists.

A number of other countries have some sort of Aggregates Levy, and such a financial tax on extraction is relatively common. The precise details of each levy vary widely, and this means that the measure should be highly applicable to many other contexts, including marine extraction of other resources, such as oil or gas. However, it is likely that certain resources such as fossil fuels are already subject to regulatory measures and so adding a levy to improve GES may be unnecessary or over-complicated. In most cases though, it is important to note that stakeholder participation, or at least support, helps the measure's implementation.

It could be more useful to apply lessons from the Sustainability Fund, whereby users of the sea bed (e.g. oil and natural gas extraction) contribute to a fund which improves the knowledge of the marine ecosystems. Here, the factors which have led to the success of the fund such as stakeholder/user involvement in the research funding process, could be applied if such a Fund was ever generated.

#### 4.2.4.4

#### Social, legal and institutional context

The Levy was a government policy which was raised through the budget and parliament. It was included as an environmental policy tool, and throughout the planning processes different agencies and actors were able to question, challenge and suggest changes to the policy. As such, the Levy has the legal basis of any other tax or Levy with the institutional capacity of the UK's Revenue and Custom's Authority behind it.

However, the legitimacy of the Levy has been challenged by the British Aggregates Association (BAA) on the grounds that it does not include all quarrying activities. The challenge is still in the European courts but an appeal has been won against the UK Government<sup>125</sup>.

The institutional context of the Levy was one of an industry with a small number of large companies and a large number of small companies under some established organisations, namely the Quarry Producers' Association, the British Marine Aggregate Producers' Association, and the BAA. .. The Levy was introduced by a government with a large Parliament majority, but the process involved negotiations with the industry and other actors. The UK's Revenue and Custom's Authority (HMRC) had the capacity to collect and monitor the Levy, and the Sustainability Fund was distributed through a number of governmental bodies and Quasi-Autonomous Non-Governmental Organisations (Quangos). There appear to be no gaps in the social or institutional contexts.

The Levy took time to move from a proposal to implementation, and included primary research into the valuation of environmental (social) impacts of quarrying. Measures were put in place to hypothecate the revenues back to the industry. The main industry bodies have not accepted the Levy, as demonstrated by the legal challenges.

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<sup>125</sup> Details of actions can be found here: [http://curia.europa.eu/jurisp/cgi-bin/form.pl?lang=EN&Submit=Rechercher\\$docrequire=alldocs&numaff=C-487/06%20P&datefs=&datefe=&nomusuel=&domaine=&mots=&resmax=100](http://curia.europa.eu/jurisp/cgi-bin/form.pl?lang=EN&Submit=Rechercher$docrequire=alldocs&numaff=C-487/06%20P&datefs=&datefe=&nomusuel=&domaine=&mots=&resmax=100)

#### 4.2.4.5 Flexibility and adaptability

There are two main aspects to the flexibility and adaptability: Firstly, the level of the Levy. This has changed twice since the inception in 2002, and the changes arise from budget announcements. These are then communicated via the UK's Revenue and Customs Authority and industry bodies. The changes however do not necessarily relate to changes in the social costs of aggregate extraction. The second main aspect is the distribution of the Fund. This showed a relatively high level of flexibility in both scale and scope, in that new projects and new types of projects could be introduced over time.

The Levy is not flexible in that it remains a flat fee per tonne of aggregate regardless of the source or type of aggregate. As a marine policy tool, it can be considered inflexible since the level is not set to specific marine contexts, and as marine extraction makes only 20% of total UK aggregate production, it is reasonable to expect that the Levy will never fully incorporate marine environmental costs.

#### 4.2.4.6 Broader impacts: risks and opportunities

In the marine case, the broader impacts are more likely to be beneficial than negative since the research outcomes of the Fund will continue to support policy making and licensing into the future, and encourage more environmentally beneficial behaviour, even after the Fund's closure. The current research will also provide opportunities for future research and other future marine environmental policies.

A possible risk would be if the court action causes the Levy to be abolished, which could then hinder future legislation in the area. The converse is also true, that it could encourage a more flexible and accurate Levy across a wider range of aggregates explicitly aimed at environmental cost reduction. But if relationships between the Government and Industry become overly antagonistic then future legislation may become hard to implement effectively.

#### 4.2.5 Enabling and limiting factors

This section will briefly look at an number of dimensions of the Levy in order to assess which factors are key to the success of the Levy and which may limit success. These will then be used to assess the applicability of the Levy to other cases.

Success of the Levy could be defined as the reduction in environmental and social costs of aggregate extraction. This was intended to be achieved partly with a shift in aggregate use from primary extracted aggregates to recycled aggregates – via the price rise of the Levy and the Sustainability Fund's actions – and through better extractive practices, encouraged through the Fund. Success is therefore about how well the Levy and Fund have changed both the extraction and use of aggregates, but also the extent to which the aggregate and construction industries have responded to the policy.

##### 4.2.5.1 Strong design

The Levy was designed to be simple and applicable broadly, rather than to achieve specific marine outcomes. The design is a basic, flat-rate levy applied to all extraction of aggregates with a few specific exceptions. The Levy is paid by the producer and applies to by-products of extraction which may also be considered (low grade) aggregates. In addition to the Levy, the National Insurance payments of employers were reduced and a Sustainability Fund developed. The Fund had a strong and flexible design which helped it meet early objectives of encouraging recycling and later objectives of wider research.

However, the Levy's design has left it open to challenges, such as court action challenging the Levy itself since not all quarrying is covered. The cancelling of the Sustainability Fund also suggests that the Levy is not focussed on environmental considerations.

#### 4.2.5.2 Stakeholder commitment and cooperation

The main quarrying and aggregate industry organizations are not committed to the Levy as it does not treat all aggregates equally, for example shale is exempt. The BMAPA (Marine producers association) does not make such a clear opposition to the Levy and seems to appreciate the research generated by the Sustainability Fund (see [http://www.bmapa.org/issues\\_levy01.php](http://www.bmapa.org/issues_levy01.php)). However, whilst the Levy remains, cooperation is mandatory as the Levy is a legal obligation.

This opposition weakens the environmental impact of the Levy inasmuch as it raises uncertainty over the future of the Levy, thus reducing the ability to plan, and may remove the Levy altogether. However, since producers have to comply, the Levy's impacts remain.

The Sustainability Fund was developed using input from stakeholders and users – in the marine case, research was targeted based on shared priorities, and the results of such research have been useful and relevant, and not just to the aggregates industry.

#### 4.2.5.3 Good information and knowledge

The successes of the Levy have depended as much on the 'soft policy' outcomes of the Fund as the financial incentives of the Levy itself. Knowledge generation and dissemination through primary research has helped increase the understanding of the marine impacts of aggregate extraction. Information dissemination, particularly in the realm of recycled aggregate promotion, has also played a part.

These impacts are generally about information flows within the industry, and since aggregates play only a small role in wider public life, this seems reasonable.

A weakness may have been to base the Levy rate on a limited set of knowledge – the Contingent Valuation Study on which the level of the levy had been set and as a technique in general was not well received by the industry (see BAA 2001 where Contingent Valuation is considered "unscientific").

#### 4.2.5.4 Control and enforcement

The Levy is administered by the HMRC and so this is a very strong enforcement. As a simple per-tonne fee, this can be calculated relatively easily from other records the companies must keep. There are criminal offences related to the Levy (HMRC 2011).

#### 4.2.6 Conclusions

The UK Aggregates Levy is an interesting case-study for looking at how non-marine specific policies can have a range of impacts on the environmental quality of marine waters in the EU. The Levy itself is a relatively simple tool with full legislative support but with opposition from some sectors in the industry. The Levy also raised monies for a Sustainability Fund which has generated useful knowledge for the marine extraction sector to improve its environmental performance.

The Levy itself seems to have been too 'blunt' to have had a large effect on aggregate dredging quantity or quality. As it was set to be a flat fee across all extraction, costs were kept low but so were outcomes. The Levy also overlaps with other policies such as the Landfill Tax which may have limited its impact. In particular, the marine licensing regime seems to have been sensitive to environmental issues from before the Levy's introduction. This affects measures of the environmental effectiveness of the levy.

## 4.3 Case study “No Special Fee” system Baltic Sea

### 4.3.1 Introduction: No Special Fee system for ship-generated waste

The “**No Special Fee**” system (NSF) is defined as a charging system where the cost of reception, handling and disposal of ship-generated wastes, originating from the normal operation of the ship, as well as of marine litter caught in fishing nets, is included in the harbour fee or otherwise charged to the ship irrespective of whether wastes are delivered or not (HELCOM Recommendation 28E/10 ‘Application of the no-special-fee system to ship-generated wastes and marine litter caught in fishing nets in the Baltic Sea area’).

The concept<sup>126</sup> of the “No Special Fee” thus means that every ship (with some exemptions) entering the port is paying a fee which is not related to whether the ship delivers the waste or not or to the quantity delivered. The fee covers the waste collecting, handling and processing including infrastructure and is distributed among ships and collected as part of or in addition to the port dues. The system is not restricted to any specific type of ship-generated waste and thus includes the most common wastes from normal operation of ships: oily wastes, sewage and garbage.<sup>127</sup>

### 4.3.2 Environmental problem and objective of the measure

(Maritime) shipping may be associated with several environmental effects. Contrasting with the vulnerability of the Baltic Sea area, this regional sea is one of the most intensively trafficked shipping areas in the world. Target area for the “no-special-fee” system is ship-generated waste and associated pollution or related impacts from (illegal) discharges (HELCOM, 2006). Due to the diverse nature of ship-generated waste, multiple pressures (and GES-descriptors) can be considered related to effects of waste from normal operation of ships (oily wastes, sewage and garbage).

According to HELCOM Recommendation 28E/10, *the “No Special Fee” system* is installed with the dual purpose to i) eliminate the economical motivation to illegally discharge waste at sea and ii) to avoid undesirable waste streams between ports, thereby encouraging a sound sharing of the waste burden. The system is as such considered as a necessary complement to the existing requirements on mandatory delivery of ship-generated waste which cannot be legally discharged to the sea.

### 4.3.3 Measure: definition and context

#### 4.3.3.1 (Legal) background and implementation<sup>128</sup>

To further address the issue of pollution of the marine environment by ship-generated waste (next to MARPOL 73/78 and Helsinki Convention), the Helsinki Commission elaborated and approved the Strategy<sup>129</sup> for Port Reception Facilities for Ship-generated Wastes and Associated Issues, also known as **the Baltic Strategy** (adopted in 1996).

Within the framework of the Baltic Strategy, countries around the Baltic Sea agreed to introduce a *harmonised fee system* for the use of port reception facilities (**No Special Fee**

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<sup>126</sup> <http://helcom.navigo.fi/stc/files/BSAP/FINAL%20Maritime.pdf>

<sup>127</sup> Cargo residues are not covered by the Baltic “no-special-fee” system. Personal communication with some ports has learned that minor amounts are also accepted under the same regime.

<sup>128</sup> This section has been based on Swedish Maritime Administration (1999) and HELCOM, 2006

<sup>129</sup> [http://www.helcom.fi/shipping/waste/en\\_GB/](http://www.helcom.fi/shipping/waste/en_GB/)

**system**).<sup>130</sup> The application of the harmonised “No Special Fee” system for the operation of reception facilities for ship-generated wastes has gradually been expanded to include first oily waste from machinery spaces (Annex I of MARPOL) as of 1 January 2000, and sewage (Annex IV) and garbage (Annex V) as of 1 January 2006. In 2007, the concept has been broadened to marine litter caught in fishing nets. In principle, the “no-special-fee” system is not restricted to any specific type of operational waste. Regarding sewage – of particular relevance for the Baltic considering the severe eutrophication status - the HELCOM Contracting Parties submitted a joint proposal to IMO to amend Annex IV of MARPOL 73/78 and to designate the Baltic Sea as a special area for sewage discharges from passenger ships.<sup>131</sup> Sewage is covered by the no special fee system, but the system does not provide sufficient incentives in absence of legislation to make sewage discharges illegal and motivate delivery in ports.

The HELCOM recommendation 28E/10 regarding the no special fee system includes the possibility for competent authorities to exempt ships from the obligation to pay the No Special Fee if engaged in (i) regular services (regular and frequent port calls) and (ii) when it is **ensured** that the **disposal requirements** will be **met on the ship’s own account** (see next section for examples).

#### 4.3.3.2 Implementation of the No Special Fee system: geographical differences

In spite of efforts to set up a harmonised system for the Baltic Sea, it appears that the fee system for ship-generated waste reception in ports has been implemented differently in the countries of the Baltic. This follows from the multiplicity of regulations and recommendations (MARPOL requirements, binding EU Directive, the HELCOM recommendation and existing or new national legislation). Such differences can exist in terms of granted exemptions, waste types and amounts under the system and the level of the waste fees.

A consultation with Baltic Ports<sup>132</sup> identified that the percentage of individual ships under the system could range from 2 to 100%, depending on the port. The decision on **exemptions** is a Port State responsibility leading to important differences between countries. Finland appears to apply more exemptions than the neighbouring country Sweden. Cruise ships can for example be exempted in Finland while this is not the case in Sweden. It is argued that the demand for an exemption is most likely inspired by economic elements and benefits of flexibility to choose specific ports for certain types of waste (own agreements for waste reception and handling).<sup>133</sup> Exempted ships need to document how they fulfil their waste disposal requirements to the national authority, and ports have no insights on these waste streams.

Implementation differences between ports also exist in the **waste types and amounts** that can be delivered under the system. Some accept any amount of oily waste, garbage and sewage within “No Special Fee” conditions, whereas others are ready to accept only a reasonable amount of waste (often since the last port of call) under the no-special-fee

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<sup>130</sup> Which does not imply equal fee rates as these are the responsibility of ports (calculation principles for fees are discussed further in the document).

<sup>131</sup> For further reading, please see [http://www.helcom.fi/shipping/waste/en\\_GB/](http://www.helcom.fi/shipping/waste/en_GB/)

<sup>132</sup> [http://www.newhansa.net/documents/Sopot\\_specific\\_Alhosalo\\_Kalli.pdf](http://www.newhansa.net/documents/Sopot_specific_Alhosalo_Kalli.pdf). Exemptions are defined by the national authorities, though own characteristics of ports (predominating passenger traffic) can lead to extreme figures.

<sup>133</sup> Personal communication with two Baltic ports.

and require additional payment for the rest of the waste (if any). Such differences between ports in applying the “no-special-fee” system are for example found regarding amounts of waste (on-board a ship) that can be left at the port<sup>134</sup>:

- Solid waste allowed to be left at the port: from 0,4 m<sup>3</sup> to unlimited
- Waste water allowed to be left at the port: from 2 m<sup>3</sup> to unlimited
- Oily waste waters allowed to be left at the port: from 2 m<sup>3</sup> to unlimited

The implementation can also differ regarding the waste types covered by the system. Some ports take within the system only black water (excreta, urine and faecal sludge) as grey water (kitchen and bathing wastewater) is not regulated by MARPOL.<sup>135</sup> Other ports have a less stringent policy and accept all ship-generated waste and even cargo residues under the indirect fee system, as the latter are usually limited to small amounts.

**Fee rates** are decided by ports. The indirect fee for waste management is included in the port fee. For most ports, fees are differentiated by type of ship (different waste pattern): ships carrying freight, tankers, passengers or cruise ships. The fee system is described in the waste management plan and national authority must control whether the proposed system for calculation can be accepted but does not comment on the level. The fee is calculated from a cost recovery perspective. Total waste costs are then allocated to different ship types according to their waste generating pattern (highest costs for cruise ships). The same principles apply for the calculation of *reductions in fees*, and reductions are usually granted for e.g. waste sorting or the reduction of the quantity of (oily) waste.

In the first evaluation (HELCOM Maritime 5/2006), nearly no countries were stating reductions in harbour fees due to (good) waste management practices. Today, in most ports such reductions on port tariffs are present. From a consultation in Baltic ports<sup>136</sup>, it appears that international cruise vessels can save up to 33% of the fee payable per passenger by sorting their waste to (approved) fractions.

#### 4.3.3.3

#### Other cost recovery mechanisms

Article 8 of the EU Directive 2000/59/EC on Port Reception Facilities states that “all ships need to contribute significantly to these costs irrespective of actual use of facilities”. The Directive allows various kind of cost recovery systems to coexist within the EU, with the only requirement that not less than one third of the total cost to be recovered is charged through an indirect fee. (Most) Baltic states have implemented the No Special Fee as an indirect fee system. It has been described already that there are some variations in implementations in the Baltic, mainly regarding limitations such as reasonable or excessive amounts (Last Port Of Call or LPOC).

Other port reception financing systems may also provide incentives for landside disposal of waste (curbing discharge at sea...)<sup>137</sup>: “free of charge” systems, “fixed fee” systems (waste disposal cost is a separate fixed fee and is paid regardless of whether or not the ship offloads waste, similar to No Special Fee); and “deposit-refund” systems which

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<sup>134</sup> [http://www.newhansa.net/documents/Sopot\\_specific\\_Alhosalo\\_Kalli.pdf](http://www.newhansa.net/documents/Sopot_specific_Alhosalo_Kalli.pdf)

<sup>135</sup> P.c. Monika Stanckiewicz of HELCOM

<sup>136</sup> Presentation at the General Assembly of the Baltic Ports Organisation in Sopot, September 6th -8th, 2007: [http://www.newhansa.net/documents/Sopot\\_specific\\_Alhosalo\\_Kalli.pdf](http://www.newhansa.net/documents/Sopot_specific_Alhosalo_Kalli.pdf)

<sup>137</sup> From Tackling Marine Debris in the 21st Century. Committee on the Effectiveness of International and National Measures to Prevent and Reduce Marine Debris and Its Impacts, National Research Council ISBN: 0-309-12698-3, 218 pages, 6 x 9, (2008). Downloaded from: <http://www.nap.edu/catalog/12486.html>

charge ships a mandatory waste management fee as a deposit, then refund all or part of this fee to those ships that use the port reception facility services. EMSA (2010) categorises cost recovery systems in no special fee systems and administrative fee systems, with multiple (smaller) variations between ports. The main difference lies in the fact that administrative fee systems do not contain a delivery right. The system consists of an administrative fee (to the port, often refundable) and separate charging based upon actual delivery (usually to private waste handlers).

#### 4.3.4 Evaluation of the measure

The instrument of the indirect fee system for ship-generated waste has been further screened against the evaluation criteria earlier defined in the report.

##### 4.3.4.1 (Environmental) effectiveness

###### Goal achievement

The evaluation of target fulfilment would require clearly defined policy objectives. In the case of the no special fee system, these have not been precisely defined. Objectives that are not quantifiable, specific or limited in time are difficult to evaluate (Van der Vlist et al, 2007). It is therefore challenging to define indicators that could relate to the earlier described dual purpose of the no special fee system: eliminate the economic incentive to discharge waste at sea and avoid undesirable waste streams between ports.

The overall objective of the no special fee system (and the wider Baltic Strategy) comes down to reducing the pollution from shipping waste, by facilitating reception of waste and providing incentives to delivery on-land. These targets could be further translated in terms of **amounts of pollution / garbage at sea** or **delivery of waste to reception facilities in ports**. This type of indicators have also been proposed to evaluate the success of the cost recovery fee systems under the EU Directive 2000/59/EC on Port Reception Facilities.<sup>138</sup> There is however a lack of reliable statistics on quantities of ship-generated wastes received by ports (EMSA, 2010).

Results and indicators will be briefly discussed for the three defined ship-generated waste categories covered by the system, (operational) oily waste, sewage and garbage or solid wastes. This assessment includes specific information from some individual ports though it is important to note that there is no complete overview of waste related information available. Ports do not necessarily compile or report the same statistics on waste (waste categories, ship categories, ...). Moreover, ports usually have no insights on ships that are exempted from the No Special Fee and / or mandatory delivery and have made own arrangements with waste handlers. The relative importance of this unknown share of ship-generated waste can differ significantly between Member States.

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<sup>138</sup> EMSA report 2006 on a workshop on the cost recovery systems of the Directive 2000/59/EC on Port Reception Facilities for ship-generated waste, 2 March 2006 Brussels.

### Oily waste

According to HELCOM<sup>139</sup>, it is not feasible to develop a reliable indicator on amounts of oil delivered by ship call due to the rather complex legislation and diverse factors affecting the amounts and ship types to be covered by the indicator. It is argued that statistics on *illegal oil spills* (i.e. from normal operation and tank cleanings, not accidental pollution) could provide an indication of the effect of the no special fee system, though it can't be isolated from the increased effectiveness of aerial surveillance (and its deterring effect). It is of note however that, even with increased aerial surveillance and oil drift control systems, polluters remain unknown in a vast majority of cases of detected illegal discharges. In 2010, out of the total number of confirmed illegal discharges (149), as little as in 9 cases (6 %) the polluters were identified.

In general, the number of detected oil spills in the Baltic Sea has been constantly decreasing, even though the density of shipping has rapidly grown and the aerial surveillance activity in the countries has been substantially improved. This evolution can be read from Figure 3. The amount of oil detected at sea has also decreased over the years.

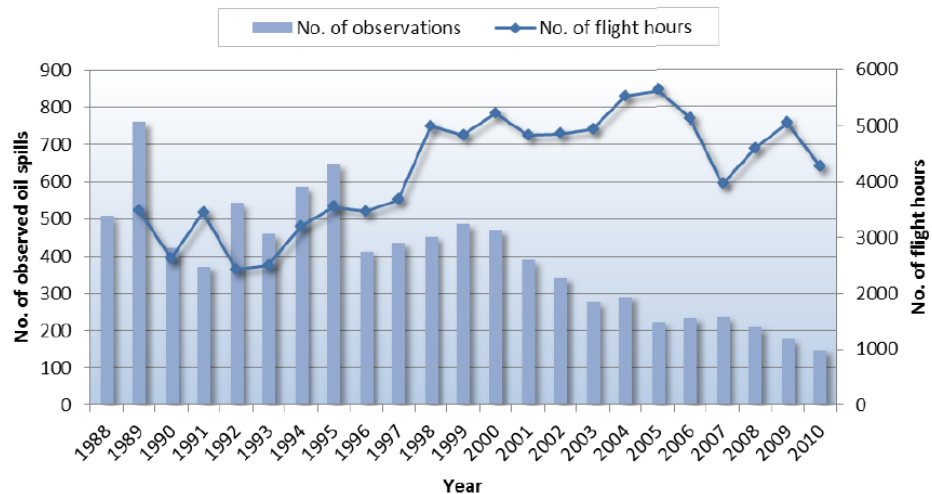


Figure 3 : Evolution of the number of detected illegal oil spills and the number of flight hours in the Baltic Sea (Source: <http://www.helcom.fi/stc/files/shipping/spills2010.pdf>)

The No Special Fee system in the Baltic has been introduced in the year 2000 for oily wastes. The above graph is showing a gradual decrease in the number of detected oil spills since but it is not possible to define a causal relationship between the instrument and the effect. Hassler et al (2010) note that the no special fee system seems to have had some effect in reducing the number of intentional spills, but argue that the fact that it is still a lot faster to clean tanks at sea than in ports, in combination with less than perfect implementation of the system, has reduced its effectiveness.

### Garbage and solid waste

An important objective of the no special fee system is the encouragement for ships to deliver waste in ports. There is no straightforward indicator to measure the implementation of the No Special Fee, the overall trend (towards the objective) could be viewed only indirectly, for example through the amounts of solid waste per ship call for

<sup>139</sup> Personal communication Monika Stanckiewicz from HELCOM.

countries/ports with available data.<sup>140</sup> Some statistics on the amounts of waste delivered to PRF have been collected by HELCOM (2010). These show a generally increasing trend that may indicate a positive development in the use of port reception facilities across the Baltic. In three countries, there is an increase in the amount of garbage delivered; in one country, a slightly decreasing trend can be observed (no trend can be determined for the fifth country due to the short data set). Little or no data is available for the remaining countries.

The same increasing trend has been confirmed by a survey in ports under the New Hansa project<sup>141</sup> on sustainable ports and cities in the Baltic: 4 ports indicated an increase in the delivery of solid wastes while 1 port identified a decrease or stable evolution. HELCOM assessed the marine litter pressure in the framework of UNEP Regional Seas Programme on marine litter (UNEP, 2009). In its analysis, HELCOM asked countries about garbage delivery to the ports. Two countries indicated that the 'No-Special-Fee' system has had an effect on the amounts of garbage delivered to the ports, whereas one responded that the system has had no effect at all. Most of the countries do not collect any relevant data at the central level, so it was difficult to assess the effectiveness of the system.

The report (HELCOM, 2009) states that economic incentives have already been introduced in the Baltic Sea area and that the Baltic Strategy on Port Reception Facilities for ship-generated wastes has probably affected the amount of marine litter in the Baltic Sea. It is argued that the main strength in the HELCOM area is that the sea-based sources are well covered by the Strategy (enforcement of existing requirements). At present no evaluation could be made on the effectiveness of the "no-special-fee" system, for example due to the lack of detailed data on the amount of garbage delivered to reception facilities per number of calls into major Baltic port of different types of ships.

### Sewage

Delivery of sewage (especially relevant for passenger ships) in ports has been subject of strong debate in the Baltic area (special area under MARPOL in the future, see paragraph 4.3.3.1). The effect of the no special fee system is likely to be impacted by the current absence of a prohibition to discharge sewage at sea. Information on port delivery of sewage is presented for some individual ports.

Today, only two of the major ports around the Baltic Sea meet the conditions of adequate reception facilities for sewage from large cruise ships (Helsinki and Stockholm). Both ports experienced an increasing trend in the delivery of sewage water in the port. In Stockholm, total delivery increased from +/- 350,000 m<sup>3</sup> in 2003-2004 to more than the double in 2005-2006 (over 750,000 m<sup>3</sup>). A gradual increase has also been observed for passenger ships and cruise ships only, with an increase from 500,000 m<sup>3</sup> to more than 600,000 m<sup>3</sup> over the past 5 years.<sup>142</sup> For Finland, delivery of sewage increased from +/- 200,000 m<sup>3</sup> in 2006 to roughly 350,000 m<sup>3</sup> in 2010. For Tallinn, another major destination for cruise ships in the Baltic, there is no clear trend in sewage delivery by ship call (different types) between 2008 and 2011 (estimate). The indicator is stable for passenger

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<sup>140</sup> Personal communication Monika Stanckiewicz of HELCOM

<sup>141</sup> Ports and city environment as a follow up of the New Hansa Sustainable Ports and Cities. Presentation by Minna Alhosalo and Juha Kalli at at Sopot, 6 September 2007.

<sup>142</sup> Port reception facilities for sewage from passenger ships. Presentation by Gun Rudeberg (Port of Stockholm) on a Workshop on upgrading port reception facilities for sewage from passenger ships, 16 June 2011 Helsinki.

ships (between 1 and 1.3 m<sup>3</sup> by call as opposed to large fluctuations for cruise ships (+/- 8 m<sup>3</sup> in 2008, below 5M<sup>3</sup> in 2009 to more than 13 m<sup>3</sup> by call in 2010-2011). Other ships have only marginal amounts compared to these ships. Trends between ports are difficult to compare considering the different reception facilities and diverse implementations of the no special fee system.

Hänninen et al (2009) state that cruise liners calling at Baltic ports seldom leave their sewage waters in port reception facilities. WWF confirms that more than half of the cruise ships in the Baltic Sea still dump their toilet water straight into the sea, even if conditions for adequate port reception facilities are met, for example like in Stockholm or Helsinki. In September 2010, at the end of the cruise season, Stockholm had 240 ship visits and only 115 used existing port facilities, some of these 115 only for small amounts, suggesting that most of the sewage, even from these, has been dumped at sea.<sup>143</sup> Helsinki claims somewhat higher figures with nearly 70 % cruise shipcalls (in 2010) using the Port Reception Facilities of the Port of Helsinki.<sup>144</sup>

#### Additionality

From available information, it is not feasible to identify a causal relationship between the installation of the no special fee system and increased delivery of ship-generated waste in ports. Sweden for example have had the no-special fee-system since 1980 and many aspects of both legislation and environmental consciousness have changed during that time. Statistics of the Swedish Transport Agency cannot be used for evaluating whether the increasing amounts of waste is due to the no-special-fee or to other causes.<sup>145</sup>

The above description has shown that, despite the increasing trend to deliver in ports, the lack of harmonisation between fee systems and differences in port reception facilities may hinder the overall positive effect. It is however important to note that the indirect fee system for all ship generated wastes (by its design) provides incentives for ships to deliver wastes in ports. No clear evidence could on the other hand be found that an indirect fee system proves to be more effective than other existing cost recovery mechanisms (EMSA, 2011).

#### 4.3.4.2

##### Information on costs and benefits

The no special fee system is integrated as an initiative in a wider Baltic Strategy, making it difficult to have a good view (and evaluation) of costs and benefits of the policy instrument itself. The next paragraphs will cover some aspects on costs associated with this waste burden (for ports and ships).

##### Cost recovery and fees

The measure is a way to (re)cover (part) of the costs of waste management in ports. In the European Directive 2000/59/EC on port reception facilities, ports should have partial recovery (at least 30%) through indirect fee but can still choose how much and how (partly variable). HELCOM states have all introduced the no special fee system, though with

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<sup>143</sup> <http://wwf.panda.org/?195090/Cruise-ships-still-dump-their-sewage-in-the-Baltic-Sea>

<sup>144</sup> Wastewater reception facilities at the port of Helsinki. Presentation by Kaarina Vuorivirta at the seminar "Baltic Ports and Environment – new regulations and challenges" held on 7th December 2010 Malmö, Sweden

<sup>145</sup> Personal communication with Stina Paulin, Environmental Specialist at the Maritime Department of the Swedish Transport Agency.

variable implementation characteristics. The indirect fee system is one of the possible schemes for cost recovery and to fulfil the requirements of EU Directive 2000/59/EC. **Implementation costs for authorities** are not likely to vary significantly between one or another cost recovery system.

Removing the economic incentive to discharge at sea *in se* would entail that ships should not face too large costs when delivering on shore as compared to the situation where they don't deliver. This **private cost for ships** then includes the waiting time, the waste fee and other potential costs related to on shore delivery. The indirect fee system by its design stimulates delivery as ships need to pay a fee per port visit even if no waste is delivered. Considering that the level of the fee is decided by ports and inspired by the cost recovery principle, the no special fee system does not result in higher or lower costs for *all* ships, as the total cost should be distributed over the ships calling at a single port. HELCOM Recommendation 28E/10 lists the costs that can be included in the fee, though not clearly defines these: investments in and operation of reception facilities, repair and maintenance costs of such facilities and costs of handling, treatment and final disposal of the received wastes.

**Costs for ports** are not assumed to be really different as compared to other charging systems. In practice, ports will estimate their costs for waste management of ship-generated wastes through a tendering procedure and projections of the port activity. Total waste costs are then redistributed over the different ship types and translated to a waste fee.<sup>146</sup> The principles of calculation of fees are reported to national authorities, the fee rate is entirely the port's business. Interviews with several Baltic ports<sup>147</sup> have shown that the waste fees more or less cover the total costs of waste handling of ship-generated wastes, though one port argues that investment costs are not (fully) recovered. It is of note that actual costs are not known in advance making it difficult to calculate the appropriate level of the fees.<sup>148</sup> In Poland, where the fee system is only partly indirect, Polish ports' adjustment to the Directive led to a loss of some 5 % of its annual revenue (Baltic Ports Organization research) and imposed additional legislative requirements of reception facilities.<sup>149</sup> These are not recovered through environmental fees. Apparently the country experiences problems in bringing these fees into the Polish system of port fees.

More detailed analysis<sup>150</sup> of **waste fees** for passenger ships in 4 ports shows that these fees not necessarily reflect the adequacy of port reception facilities in specific ports. EMSA (2010) also identifies that, in practice, the relationship between fees and costs often remains unclear in EU Member States and there is a lack of transparency in relation to the underlying calculation leading to the price for different Port Reception Facilities services.

De Langen et al (2008) note that for large ships, the waste disposal costs (waste fees) are only about 5 % of the total port dues. For small vessels, waste disposal costs can be a more significant percentage of the overall port dues.

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<sup>146</sup> Personal communication Gun Rudeberg, General Counsel and Head of Environmental Affairs, Port of Stockholm.

<sup>147</sup> Ports of Stockholm, Helsinki and Tallinn.

<sup>148</sup> Baltic experience of the no special fee system for port waste reception. Presentation by Markus Helavuori, Maritime Inspector of the Finnish Transport Safety Agency. 20th international KIMO conference, 9 October 2010.

<sup>149</sup> <http://www.greenport.com/news101/europe/legal-uncertainty-hinders-polish-port-development>

<sup>150</sup> Analysis presented by Ellen Kaasik, port of Tallinn, including Tallinn, Riga, Stockholm and Helsinki.

#### Benefits of reduction of pollution or waste discharges at sea

Some indicators and figures have illustrated that the instrument may have contributed to an increase in the amount of waste delivered in ports and thus reducing the dumping of waste at sea. The benefits of the measure can however not be estimated based on available information. It is important to note that the costs associated with pollution from shipping are significant. Any positive impacts of the measure could help to reduce the costs of (illegal) pollution from ships. Some examples are listed below:

- Costs of marine debris are difficult to calculate (Kalli et al, 2005): Lost tourism, beach cleanups, maintenance and repairs of damaged vessels and losses in fishing are examples contributing to unknown total costs.
- Beach-clearing operations: The costs for beach cleaning and removal of litter from harbour waters in Poland was 570,000 € in 2006 (UNEP, 2009). UK municipalities spend approximately €18 million each year removing beach litter. Similarly, municipalities in the Netherlands and Belgium allocate approximately €10.4 million per year to clear beaches where ship-source litter makes up a large proportion of marine litter.<sup>151</sup>
- Bickel et al. (2006) estimate that the environmental cost of a tonne of oil spilled is € 15,000, when considering the costs of natural resource damages, costs imposed on the users of the marine environment and costs of cleaning up.

#### Financing of port reception facilities or management of ship-generated waste

The provision of port reception facilities poses a burden on ports as the investments are often large and the reception of wastes demands extra work for the port staff. The adequacy of facilities is however a necessary condition for a successful implementation of the no special fee system, avoiding undesirable waste streams between ports. This can be considered as the main objective of the EU Directive 2000/59/EC. Information on investments and port costs are not easily shared as ports are private actors in a competitive business.

#### 4.3.4.3

##### Suitability – Fit for use (context) and feasibility

Pollution from shipping has been a major pressure in the Baltic for a long period as it is one of the most heavily trafficked seas. The Baltic Strategy had already been implemented before the EU introduced its Directive 2000/59/EC on port reception facilities. The no special fee system can be considered as a single response to the multiple pressures related to ship-generated wastes.

The system is however not likely to work when it is not embedded in a wider strategy or (legislative) framework, covering other (regulatory) incentives to deliver waste and attention for a harmonisation or upgrade of adequate facilities. The design of the system includes good incentives for ships to deliver on land (marginal cost of actual delivery low) though various interpretations (restrictions in amounts or types of waste under the system, granting of exemptions) and inadequate port reception facilities risk to limit the incentive element for ships and a fair distribution of the waste burden between ports.

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<sup>151</sup> Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas

It is of note that the indirect fee system is considered as a suitable tool by different stakeholders. The European Community Shipowners Association (ECSA) believes that most of the troubles with the application of fees (as required by Article 8 of the EU Directive 2000/59/EC) could be solved if the principle of “no-special-fee system” was widely applied on ships (excluding exemptions).<sup>152</sup> ECSA emphasises that the system would need to be reasonable and transparent and non-discriminatory and not a back-door toward increased port earnings. Seas At Risk refers to direct charging of waste reception as the major disincentive to the use of port reception facilities. Finland national authorities also believe that a pan-European No Special Fee system, including mandatory delivery of waste would be beneficial. It is argued that the HELCOM system, with all its limitations (different implementation, unfair sharing of waste burden, ...), still works better than the Directive as it is today.<sup>153</sup>

It is considered essential to have the (harmonised) system applied in a wider geographical area, in order to create a level playing field. A successful implementation in other regions with non-EU countries (e.g. Black Sea) could only follow from international legislation (e.g. IMO). In order to be effective, (minimum) standards for adequate reception facilities, (mandatory) delivery rules and rights (and associated reporting and control) at international level may also be needed. This should be supported by ports and the shipping sector. HELCOM also indicates the importance of the (revision of the) EU Directive for facilitating the implementation of the system in order to avoid a differing or contradictory vision between Baltic and other EU Member States.<sup>154</sup> Differences in charging systems can make some ports more attractive than others (De Langen et al, 2008), in opposition to the objectives of the HELCOM recommendation 28E/10 where a fair sharing of the waste burden is proposed.

#### 4.3.4.4 Social, legal and institutional context

The **setup and legal base** for the no special fee system in the Baltic has been described in an earlier paragraph 4.3.3.1. The HELCOM Recommendation 28E/10 can only be considered as soft legislation as HELCOM does not enforce its recommendations (Ljunberg (no date)). Contracting Parties need to translate the Recommendation in national legislation to make it binding. EU member countries (8 Baltic States) are bound by the EU Directive 2000/59/EC. This has resulted in different implementation of the indirect fee system in Baltic countries, though HELCOM claims that they have generally inspired their fee systems on the HELCOM Recommendation.

In a wider context, the very nature of shipping activities also makes it difficult to **control** the *actual delivery of waste* (mandatory delivery in Baltic is stricter compared to the requirements of the EU Directive 2000/59/EC). The port itself does not control if waste is actually delivered or whether ships leave ports with (too much) waste on board. Enforcement appears to be difficult for Port States, especially related to the delivery of

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<sup>152</sup> ECSA contribution paper to EU consultation (15/09/2011): Impact assessment for a possible revision of Directive 2000/59/EC of the European Parliament and of the Council of 27 November 2000 on port reception facilities for ship-generated waste and cargo residues.

<sup>153</sup> Baltic experience of the no special fee system for port waste reception. Presentation by Markus Helavuori, Maritime Inspector of the Finnish Transport Safety Agency. 20th international KIMO conference, 9 October 2010.

<sup>154</sup> Personal communication Monika Stanckiewicz of HELCOM

waste.<sup>155</sup> Statistics from the entrepreneur or waste handler (amount and types of waste) are rarely compared with the notification form unless significant differences could be expected. Regarding *illegal pollution*, the Helsinki Convention has installed a duty for the States bordering the Baltic Sea to conduct aerial surveillance for detecting suspected offenders of anti-pollution regulations at sea. Aerial surveillance is carried out regularly in most parts of the Baltic, though some problematic issues should be improved: some Baltic states are not able to detect the spills at night or in poor visibility (no remote sensing equipment), some states do not carry out surveillance flights in accordance with HELCOM Recommendations and only a small part of potential polluters are identified and an even smaller part are brought to justice. (HELCOM, 2006). Difficulties are also experienced when it comes to the control of the *waste management practices from exempted ships* due to lack of resources.<sup>156</sup>

The indirect fee system is inspired by the polluter pays principle though allocation of the estimated costs to polluters can vary among ports. HELCOM Recommendation 28E/10 states that the fee system has to be fair, transparent, reflect costs, and clear for port users. It can for example be based on the vessels gross tonnage or the number of passengers. ECSA<sup>157</sup> argues however that the use of the Gross Tonnage (GT) as differentiation makes no sense as GT has no relation with the amount and type of ship-generated waste. Waste fees for large ships (in terms of GT) can significantly differ from others. Seas At Risk<sup>158</sup> suggests that some form of exemption or rebate on harbour fees may have to be implemented for ships making frequent, short journeys between ports, so they are not faced with a higher cost-burden.

No clear relation could be identified between waste fees and the adequacy of the port reception facilities or delivered services. The shipping sector claims that these differences and the lack of sufficient port reception facilities indeed may be disincentives for delivery in ports, but overall they are in favour of the system.<sup>159</sup> According to Ljungberg (no date), ports have criticised the No Special Fee system since it does not encourage vessels to reduce the amount of waste produced. Interviews with 1 port and Member State indicated that fee reductions for good waste management practices on board may give some motivation for the shipping sector ('carrot').

BPO (2011) has indicated that many Baltic ports are skeptical about upgrading sewage reception facilities for ships. They are not sure if the investment in sewage reception facilities will be proportional to the environmental effect. They also argue that port reception facilities are not the only solution for preventing sea pollution by sewage from ships. Passenger shipping industry could invest in onboard sewage treatment plants, which would make ships less dependent on reception facilities in Baltic Sea ports. BPO (2011) provides figures for associated costs showing that the estimated cost of onboard

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<sup>155</sup> Baltic experience of the no special fee system for port waste reception. Presentation by Markus Helavuori, Maritime Inspector of the Finnish Transport Safety Agency. 20th international KIMO conference, 9 October 2010.

<sup>156</sup> Personal communication Kaarina Vuorivirta, Port of Helsinki. Referring to the capacity of the Finnish Transport Safety Agency.

<sup>157</sup> ECSA contribution paper to EU consultation (15/09/2011): Impact assessment for a possible revision of Directive 2000/59/EC of the European Parliament and of the Council of 27 November 2000 on port reception facilities for ship-generated waste and cargo residues.

<sup>158</sup> Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas

<sup>159</sup> Personal communication, Mattias Rust of WWF

sewage treatment plant may be less cost efficient than for reception facilities in ports.<sup>160</sup> A survey on several Baltic ports shows that 60% of the ports are satisfied with the system.<sup>161</sup> It has however been stated that the issue of “waste tourism” is apparent: Ports and countries with 100% implementation of the indirect fee system and providing good waste reception services are more attractive for ships.

#### 4.3.5 Enabling and limiting factors

The evaluation has shown that several factors can have an influence on the delivery of ship wastes in ports and more specifically the effect of a certain fee system in ports. The following paragraphs will further look at the elements that play a role in the overall success or potential difficulties arising from and within the system.

##### 4.3.5.1 Strong design: the need and challenge of harmonisation

The Baltic region has developed a framework and strategy to stimulate delivery of ship-generated waste in ports.<sup>162</sup> The HELCOM guidelines provide more specific design elements<sup>163</sup> compared to Directive 2000/59/EC, but practical implementation still varies throughout the Baltic region. HELCOM Recommendations are **not legally binding** and Contracting Parties do not necessarily translate these provisions in national law.

The current absence of a strict legal framework for certain wastes may encourage ships to discharge at sea, for example sewage or certain MARPOL annex V wastes (garbage). This practice is further motivated by the **lack of uniform disposal fees** or the different implementation of the “No Special Fee” system. WWF argues that this situation creates **uncertainty** amongst ship owners and lack of incentives for ports to upgrade their facilities. Different ports work with their own waste handling system based on different types of cost recovery which often remain rather vague.<sup>164</sup> This creates unclear situations about the amount of waste that can be delivered, the level of the fee, the time it takes to deliver and the available facilities in the harbor. “Seas At Risk” further argues that this complex situation most likely results in vessels continuing to dump waste.

Without ignoring the presence of other fee systems that could provide incentives for ships to deliver waste in ports, some conditions for an indirect charging system can be identified.

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<sup>160</sup> Port reception facilities for cruise sewage in the Baltic Sea – presentation, Bain & Company, 2010.

<sup>161</sup> Port and City Environment as a follow up of the New Hansa Sustainable Ports and Cities. Presentation by Minna Alhosalo, Juha Kalli at Sopot, 6 September 2007. This has been confirmed by personal contacts with 3 Baltic ports.

<sup>162</sup> Baltic Master II. Progress report May 2010. Project financed under the European Union’s Baltic Sea Region Programme 2007–2013.

<sup>163</sup> E.g. definition of regular services as a basis for exemption.

<sup>164</sup> Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas

Key characteristics of a charging system including the right incentives to deliver waste in ports are listed below, combining the perspective of different stakeholders (shipping, ports, NGOs):

- **Harmonised, explicit and enforced** charging system: transparency is important for ships in order to know in advance the level of the fee. The introduction of a harmonised system (and good implementation thereof) in a wider geographic area (regulatory issue) can be hampered by the competitive environment where ports and shipping companies are operating. Ports may have the economic motivation to make their port more interesting for ships, e.g. by aiming to attract lower waste quantities that could result in lower waste costs / fees and port fees for (all) ships. Different charging systems may impact waste streams between ports (see for example paragraph 4.3.4.3).
- Waste fee included in the port fee, not depending on actual delivery of waste (No Special Fee)
- **Differentiated** charging system, to give incentives for **good waste management practices** on-board (minimise waste amounts and facilitate waste handling).

Both HELCOM Recommendation and the EU directive have described costs that are related to port reception facilities in general terms. In order to have a more harmonised design of the cost recovery system, a **better definition of costs** that can or should be included is needed.<sup>165</sup> In workshop reports on cost recovery systems under Directive 2000/59/EC<sup>166</sup>, it was argued that some Member States worked with the IMO interpretation of costs of port reception facilities (as a baseline), though the problem of different interpretations across Member States on the range of port reception facilities costs that could be recovered persists as of today. No evidence could be identified for the Baltic States neither, though individual contacts seem to confirm that ports are more or less able to recover the port reception facilities costs (no definition or calculation provided), as described in paragraph 0. Waste fees have been found to be different among ports while not clearly reflecting the adequacy of reception facilities. The above may confirm that additional guidance to the definition of port reception facilities costs is advisable.

#### 4.3.5.2

#### Stakeholder commitment and cooperation

Despite an immense legal framework controlling discharges from ships in the Baltic Sea the prevention of pollution can only work satisfactorily if all the actors involved work together and take their particular responsibility.<sup>167</sup> Effective handling of ship-generated waste requires cooperation between different parties and **mutual understanding** appears to be the key to facilitate operations. Several of these elements do not relate to the fee system specifically, but do hinder or influence the motivation for ships to deliver their waste in ports.

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<sup>165</sup> See for example EMSA report 2011 on a workshop on Port Reception Facilities for ship-generated waste and cargo residues, 13 & 14 April 2011 Lisbon or Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas

<sup>166</sup> EMAS Workshop reports 2006 and 2011

<sup>167</sup> Baltic Master II. Progress report May 2010. Project financed under the European Union's Baltic Sea Region Programme 2007–2013.

For ports, this would mean that they must facilitate discharges in ports and not pass on the problem to other ports. Baltic ports are currently mainly cooperating by sharing best practices at national or Baltic Sea level, while there are limited opportunities for port cooperation to lower waste handling costs (different entrepreneurs and local procedures). The relation between ports and ships is reflected in the provided / received services and the associated cost recovery system. Good **communication** between the ship and the port is indispensable in effective handling and is in the benefit of both.

Several initiatives have been launched in order to address the problem of lack of harmonisation between waste management practices on board ships and the requirements defined by ports (e.g. waste sorting). The latter can be further related to the next steps in the waste chain, most often the organisation of the municipal waste management. This is a major challenge for ships as these are calling at multiple ports and countries/regions with differing requirements. An **international agreement** or classification can be considered as a prerequisite for successful harmonisation of waste collection in ports, provided that the next steps in the waste chain can also satisfy the stated requirements.

PIANC (2011) is stating that improvements in waste management rely on the willingness of the industry to perform according to modern (land based) standards, since securing the enforcement of regulation at sea is challenging for authorities. It is argued that the **awareness** of the general public and the users of shipping services may have more effect than regulation. Ships (e.g. passenger ships) already put a large effort in sorting systems, but this effort is meaningless without an active and prepared counterpart on shore (see 4.3.5.3). Shipping companies could be encouraged by incentive-based port dues (“carrot”), though other elements also play a role in developing good waste management practices on board of ships (e.g. cleaner seas are also in the benefit of cruise ships, growing environmental awareness, increased control of discharges may influence waste management on board, ...).<sup>168</sup>

#### 4.3.5.3

##### Adequate (reception) facilities

According to HELCOM, “**adequate port reception facilities**” means facilities that meet the needs of ships using them, and don’t cause **delays** to ships. Port reception facilities and their capacity are related to the traffic pattern (frequency and type of ships visiting given port) and future traffic developments. HELCOM established a Cooperation Platform on Port Reception Facilities in the Baltic Sea in order to promote a dialogue on the provision of adequate port reception facilities for sewage in passenger ports of the Baltic Sea among key stakeholders (BPO, 2011). The Platform is grouping all relevant stakeholders e.g. passenger ports, shipping industry, national administrations and municipal wastewater treatment plants. Inadequate port reception facilities may be a serious impediment to the reduction and prevention of discharges at sea. It is often argued that time is too valuable for ship owners to wait for reception facilities and they tend to leave the harbour anyway. One port has stated that the lack of adequate facilities is a key limiting factor for a good functioning of the no special fee system, as this inevitably results in waste tourism between ports.

To achieve the goal of zero discharge at sea, ships need to be able to discharge their waste at ports and should have incentives (or at least no disincentives) to do so. While parties to MARPOL are required to ensure adequate port reception facilities, the

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<sup>168</sup> Personal communication Gun Rudeberg, Port of Stockholm.

**standards for adequacy** are unclear. Additional guidance provided through MARPOL does not establish (qualitative and quantitative) minimum standards. IMO could provide assistance to achieve these standards and it would be essential to include port managers and users in the development of clearer standards.<sup>169</sup> ECSA (2010) believes that adequacy should be defined by the shipping industry and not the other way around and defends the combination of adequate reception facilities and the No Special Fee system. Kalli et al (2005) state that the actual reception of waste is not a key problem for ports, but further disposal and treatment (in an environmentally sound way) may be a major challenge. Ports do not have waste incinerators or other methods to treat waste by themselves. This means that other parties play an important role in building a waste management system in a port. At a recent HELCOM meeting in September 2011, the **role of the extended part of the waste handling process** has been confirmed. Ports have very different starting points depending on the (waste) capacity of the municipality they are located in. This has an impact on both the fees they are paying (to waste handlers) and their reception capacity. WWF claims that basic demands on the “extended” waste handling process would be needed and relevant national authorities would need to guide and enforce both ports and municipal waste treatment plants.<sup>170</sup>

#### 4.3.5.4

#### Control and enforcement

Control on illegal pollution from ships is a key element to further encourage ships to deliver waste in ports instead of discharging at sea. Illegal pollution in the Baltic area is generally controlled through **aerial and satellite surveillance**. HELCOM (2010) mentions that the Baltic Sea region has one of the highest rates of verifications and feedback on satellite oil spill indications. Although most parts of the Baltic with regular traffic zones are covered by national aerial surveillance, some Contracting States still do not carry out surveillance flights in accordance with the HELCOM Response Manual and the Recommendations. Hassler et al (2010) explicitly state that even when a no special fee system would work as it is supposed to, operators may nevertheless have considerable incentives to clean tanks at sea due to time savings. The authors provide no detailed information or evidence on such practices, but implicitly suggest that the limited or lack of surveillance in certain areas opens the door to (illegal) tank cleanings at sea. They refer to the large differences in flight hours in different regions and expect ships to choose certain areas rather than others.

Moreover, despite improved mechanisms of detection, investigation and prosecution of polluters, there is still a **low probability for being convicted** and ships still discharge illegally even though the economic driver for this activity has been reduced significantly during recent years (HELCOM, 2006). HELCOM's Clean Seas Guide 2009 included that Baltic Sea States have agreed to **harmonize administrative fines** by deciding on a (dissuasive) minimum level.

A major problem faced by port authorities concerns the notification of a ship's next port of call. Recent research indicates that substantial numbers of ships do not end up

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<sup>169</sup> Tackling Marine Debris in the 21st Century. Committee on the Effectiveness of International and National Measures to Prevent and Reduce Marine Debris and Its Impacts, National Research Council ISBN: 0-309-12698-3, 218 pages, 6 x 9, (2008). Downloaded from: <http://www.nap.edu/catalog/12486.html>

<sup>170</sup> Personal communication Mattias Rust of WWF

disembarking at the port they indicated to Port Authorities.<sup>171</sup> **Port States** need to **control** the mandatory delivery of wastes and need to ensure that exempted ships also fulfil waste management obligations. Some countries point at the difficulty to effectively control these requirements (e.g. Finland).

#### 4.3.6

#### Conclusion

The idea of an indirect fee system (e.g. no special fee) is that ships will use the facilities they have already paid for as the marginal cost should be close to zero. Multiple **factors** can influence the **success** of this “by design” incentive to encourage delivery of wastes in ports, most importantly the institutional framework and design or roll-out of the instrument. The lack of harmonisation (in the Baltic and the EU by extension) hinders the full potential of the No Special Fee system as an instrument. This harmonisation is targeted by HELCOM but is not enforceable (no *strict legal framework*). The EU Directive on port reception facilities aims at the further development of these facilities in Member States, leaving ports and countries a degree of freedom to decide on the port reception facilities financing mechanism. The No Special Fee system can only work in combination with other policy instruments (prohibition of discharging, e.g. MARPOL special area, mandatory delivery) that are generally difficult to *control*. These difficulties cannot be overcome at national level and would require an international or at least regional cooperation (e.g. Baltic and North Sea) in order to create a level playing field for competitors. Additional difficulties arise from equity issues (fair sharing of the cost burden amongst ships and between ships and ports) or bottlenecks in the extended waste chain. Cooperation and the involvement of all stakeholders in defining the requirements (e.g. adequate port reception facilities) may help to increase acceptance and uptake of the necessary actions. The elements identified through the evaluation of the No Special Fee case in the Baltic Sea further confirm the findings from chapter 1 on key influencing factors.

Based upon (some quantitative) figures for selected ports or countries, it is reasonable to assume that the No Special Fee system contributed to increased delivery of wastes in ports (**effectiveness**), though uniform and reliable statistics to confirm this positive evolution are generally lacking. The effect of the No Special Fee system can't be isolated from the wider strategy to reduce (illegal) pollution from shipping. A No Special Fee system should be combined with mandatory delivery, strict legislation on the prohibition of (harmful) discharges, sufficient port reception facilities and effective control.

The No Special Fee system has gained acceptance from different stakeholders. Shipping industry believes it is a good and **suitable** system if it is applied in a transparent and harmonised manner. Environmental NGOs oppose against (all) direct charging for waste services as this is considered as the largest disincentive to deliver on land. A majority of Baltic ports is also in favour of the system while not ignoring the necessity of an increased harmonisation of the implementation in order to have a more fair sharing of the waste burden.

The case study has shown the potential positive effect of the No Special Fee or (100%) indirect fee system. No sufficient evidence could be collected however to demonstrate a larger incentive effect for ships to deliver waste in ports compared to other port reception facilities charging / cost recovery systems. The key element for a charging system is that

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<sup>171</sup> Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas

mechanisms should not include any financial disincentive to use waste reception facilities in ports. Fee systems should be fair and transparent. For them to be really effective, the system should preferably be harmonised over a wider geographical area. Diversity in implementation, aggravated by varying levels of adequacy of port reception facilities has maintained uneven waste flows (and associated waste costs) between Baltic ports. The risk of 'waste tourism' is even higher when regarding at the wider EU level and considering the competitive environment where ports and ships are operating.



## 4.4 Case study Real Time Closures of Scottish Fisheries

### 4.4.1 Introduction: Real Time Closures of fishing grounds

Closing access to fisheries is a standard policy tool, but often unpopular with the affected fishermen. Instead of long-term or permanent closures, and by using up-to-date information systems, closures can be managed in 'real-time', that is, on a day-to-day or week-to-week basis. Such systems reflect the flexibility of fish population movements as well as changes in the economic and social context of fishing.

Whilst not the first in the world, the Scottish Real Time Closure (RTC) scheme was the first in the EU. It has developed since its pilot in 2007 and has inspired other RTC schemes both in the EU and further afield.

### 4.4.2 Environmental problem and objective of the measure

White fish stocks, especially cod, are threatened in the North Sea, but remain important for local fishers and communities. The RTC scheme aims to reduce cod mortality by reducing discards without large economic or social costs. It aims to do so by diverting fishing effort away from the areas with the most cod. This is part of a wider scheme that manages fishing effort, and in doing so works with the quota system. That is, the quota system limits how many fish can be landed, but effort management systems such as the RTCs make it less likely that vessels overfish by making it harder or more expensive to catch fish per unit effort. This should reduce discards by reducing the quantity of over-quota catch as there is a greater incentive to fish efficiently and within quota.

### 4.4.3 Measure: definition and context

#### 4.4.3.1 (Legal) background and implementation

The **Common Fisheries Policy** is the EU's policy for managing fish stocks and allocating fishing resources. It has been reformed and updated a number of times, and future reforms are planned to be implemented on 1 January 2013<sup>172</sup>. In the wake of the 2002 CFP reform, the UK introduced in 2005 the **Cod Recovery Plan** (CRP), which focused on limiting days at sea to limit effort. The **Conservation Credits Scheme** (CCS) is the scheme used by the Scottish Government to manage fishing effort under the Cod Recovery Plan's 2007 changes. This has the aim of making sure that whitefish stocks in Scottish waters can recover to sustainable levels, specifically by lowering instantaneous cod mortality by 25% from 2008 to 2009 (Bailey et al. 2010). In this scheme a basic fishing time quota is given to cod fishing boats and extra day quotas can be awarded if the boats take up certain practices such as more environmentally sensitive equipment or respecting various closed areas<sup>173</sup>. The different options are chosen by the vessel's owners or skippers and carry different quotas as well as different implementation costs. The scheme was originally voluntary but had a 94% participation rate (WWF 2009). **Real Time Closures** were the most popular voluntary option, and are now a compulsory part of the CCS (which itself is still voluntary).

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<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/873&format=HTML&aged=0&language=EN&qu&iLanguage=en>

<sup>173</sup> <http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681#a1>

The Conservation Credits Scheme (and therefore the Real Time Closures) is negotiated by a steering committee of 25 members, comprising of representatives of stakeholder groups including environmental, social and industry representatives. The group allows changes and revisions to the RTC scheme over time– for example, changing the maximum size of a closed area.

#### Specific details of the RTCs

The RTC scheme was first piloted in 2007. After the pilot, the specific details have changed regularly. In particular, the scheme changed from aiming to protect juvenile cod to protecting all cod (Catchpole and Gray 2010).

The closures are expected by some observers to achieve an 11% reduction in cod fishing mortality based on 2008 data (Bailey et al 2010, Holmes et al 2011). This is not an official target but rather an expectation of how the policy can work towards the overall CCS target of a 25% reduction. The 11% reduction was calculated using landed cod weights before and during the pilot closures (Holmes et al 2011) and so may not be the best guide for the revised RTC's impact.

#### Threshold Triggers

A closure of an area can be triggered in two ways. One is if actual cod catches can be observed to be at a certain level (observation trigger), the other is less accurate but more frequent due to lower costs, and is based on calculating how easily fish were caught based on landings data and vessel location monitoring data (analytical trigger).

The observation trigger is based on an observed positive sample of catches, which is currently 40 cod caught per hour's trawling as seen by an observer on board a vessel. The cod can be any size. The threshold level can be changed based on observer data collected by Marine Scotland (Science)<sup>174</sup> and the distribution of cod per hour over observed trips<sup>175</sup>. This gives flexibility to the scheme, so that year-on-year changes in cod levels can be integrated into the definition of the closures.

Analytical triggers are based on combining cod landed data with Vessel Monitoring System data (GPS signals from boats) and log book data. These signals provide information about location and speed of all vessels over 15m long, and total trawling time can be estimated. A number of other parameters have been added to the scheme or adjusted over time to take into account various geographic, economic and environmental considerations.

#### Closed Areas

The pilot specified that the closure areas were to be 7.5 nm x 7.5 nm, or just over 50 sq nm. By 2009, the area was 50 sq miles. In June 2010 the maximum area of a closure is 225 sq nm. Closures last up to 21 days but occasionally may be shorter in the presence of other closures or protected zones (see below).

Within 12nm<sup>176</sup> of land the closures are more flexible in size and shape than the closures described above, and a positive sample of an observation trigger is needed (see above).

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<sup>174</sup> Marine Scotland is the overall department and Marine Scotland (Science) or MS(S) is the part directly responsible for the CCS

<sup>175</sup> For further information, see Bailey et al (2010), page 21.

<sup>176</sup> Nm – nautical mile = 1.852 km

Closures close to land are only considered in exceptional circumstances and under consultation with the steering group to provide the industry with a say. This is because the 12 nm coastal zone represents different economic factors.

#### Monitoring, Penalties and enforcement

The scheme is monitored in a number of ways. The Scottish Government's Marine Monitoring Centre uses the Vessel Monitoring System data to observe where vessels are and so cannot notify them directly if they are in a closed zone. Some trips include observers from various bodies including the Scottish Fisheries Protection Agency and independent observers (Scottish Government 2009). Closed Circuit Television cameras on board ships and skippers' log books are also used to help monitor catches. Vessels were encouraged to volunteer information about areas of high abundance.

The Conservation Credits Scheme steering group is involved in key decisions such as adjusting various parameters. It provides a voice for all major stakeholders and allows the policy to be flexible and relevant.

The scheme has always been voluntary, although since 2009 it has been a mandatory part of the Conservation Credits Scheme (which is still voluntary). After a closure has been declared, agents, skippers and organisations are notified by email, letter and a website with continuous updates<sup>177</sup>. The penalties for fishing in a closed area are reductions in the number of days fishing allowed (Scottish Government 2011). In 2009/10, seven penalties were issued.

#### Take-up and outcomes

In 2008, there were 15 closures, rising to 144 in 2009 and 165 in 2010. There are 163 as of the 4<sup>th</sup> November 2011, with 10 arising from observation trigger. Closures occur over an area of 225 square nautical miles each.

The pilot scheme is estimated to have saved the capture of 300,000 juvenile cod (Catchpole and Gray 2010), although as will be explored later, other studies note that as the effort is displaced, fish mortality savings are difficult to precisely allocate. WWF (2009) note that although the scheme was voluntary, in 2008 compliance was almost 100% - this includes both the Scottish fleet taking part in the scheme and foreign vessels in Scottish waters. Indeed, Needle and Catarino (2011) note that other nation's vessels are notified of closed areas and anecdotal evidence suggests they generally respect the closures. The relatively low rate of incursions and penalties suggests that the scheme is well observed.

- There will be a maximum level of eleven closures (plus three extra in the event of a positive sample) set at any one time. If eleven closures cannot be established then the maximum possible shall be established.<sup>178</sup>

<sup>177</sup> <http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681/closures/closed> for the coordinates, <http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681/closures/ciz> for a map also showing CIZs, Juvenile RTCs and the 12 nm boundar.

<sup>178</sup> This means that (a) under usual analytical triggers there can only be 11 closures. (b) if there are observational triggers to cause closures, these can cause the maximum to be increased by up to three. (c) if the analytical triggers do not cause 11 closures at any one time then the maximum possible number of closures will be implemented.

Closures within the 12 mile zone can only be established in exceptional circumstances which may require consultation with industry representatives;

- Closures will last for a fixed period of 21-days after which the area will automatically re-open.

#### 4.4.3.2 Relation to other policy initiatives

From 1<sup>st</sup> September 2009, the European Community and Norway have together instituted a RTC scheme in the North Sea and Skagerrak for juvenile cod, haddock, whiting and saithe. This scheme is similar but independent to the Scottish North Sea RTC. The scheme is not voluntary and is for all vessels in the area<sup>179</sup>.

#### 4.4.4 Evaluation of the measure

##### 4.4.4.1 (Environmental) Effectiveness

The environmental effectiveness of the policy would be measured by how well it is reducing cod mortality. A number of studies have been undertaken to assess this effectiveness. Success would be measured by how much the RTCs are contributing towards the general CCS target of a 25% reduction.

However, it is very difficult to assess cod mortality changes since data concerning discards are limited. Whilst on-board monitoring can collect this data, it is expensive to monitor all discard behaviour. Instead, it is usually extrapolated from sample observations and landings data. A number of studies have attempted to assess the impacts of the scheme, described below:

Bailey et al (2010)'s paper is a summary document for the European Parliament which looks at RTCs worldwide, but for Scotland in detail. Amongst other things, they find that vessels tend to move away from closed areas to areas of lower concentration (this aspect is developed in Needle and Catarino, 2011). Also, landings data for vessels observed to have been operating in areas subsequently closed and after closure suggests an estimated reduction in catches of 707 tonnes in 2009<sup>180</sup>. A brief stakeholder analysis was carried out by Bailey et al (2010) finding that RTCs were welcomed by the WWF, Royal Society for the Protection of Birds (RSPB), and the Scottish Fishermen's Federation (SFF).

However, they also note a number of key limitations to their conclusions. Importantly, RTCs cannot be compared against a control case. There are therefore no data on the level of catches or the fishing effort if the closures were not in place. Also, evaluation is limited as the RTCs displace fishing effort, but the aim is reduced mortality. RTCs do not necessarily affect total effort.

Needle and Catarino (2011) developed the analysis used by Bailey et al (2010) in order to estimate the extent to which vessels moved away from closure areas to areas of low cod concentration, in other words, the extent to which RTCs impact fishing effort. Data on fish concentrations and vessel monitoring systems are used to conclude that RTCs are

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<sup>179</sup> For more details see the Scottish Government website:

<http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681/closures/Juvenileclosedareas>

<sup>180</sup> See Holmes et al (2011)

likely to have reduced cod mortality. However, the authors do not explore the impact on other fish stocks, and there is a chance that by diverting effort away from cod, other species such as haddock may be adversely affected. The main conclusion is that fishing effort is displaced.

Holmes et al (2011) looked at compliance with the scheme and developed estimates of catch savings, building on work presented in Bailey et al (2010). This paper does not focus on RTCs, but does provide some results for RTCs separate from other CCS policies. Again, they find that there is compliance with the scheme, and that it is likely that vessels would have operated in the areas if they had not been closed. Catch savings were found, but less than expected

The Good Environmental Status (GES) specified by the MSFD is for populations of commercial fish stocks to be within sustainable limits. By helping reduce cod mortality, the RTC scheme contributes towards this with little impact against it. However, it does not appear to be as strong a scheme in terms of GES contribution as originally hoped. Whilst relatively little is known about cod patterns and the complex population dynamics, the scheme does seem to be able to adapt itself to respond to advances in such knowledge. The latest increase in the area of the closure zones may lead to a more noticeable difference in cod populations or in estimated catches and mortality since the increased size is expected to better reflect the cod movements.

#### 4.4.4.2

##### Information on costs and benefits

The financial costs to fishers or to the authorities are not explored in the literature. It can be assumed that the costs are low; costs to fishers are limited to fuel and time costs if they have to move out of a closure area or change plans because of closures. This may be more or less significant depending on the behaviour. Reporting costs are likely to be low. It should also be noted that the benefit stream in terms of increased catch in the future would lie with the fishermen.

Costs to regulators are likely to be small to medium, since the infrastructure already exists and key data was already being collected. In this case, the costs are monitoring and communication costs. For example, it would take time to calculate analytical triggers, and then to inform and update the vessels. If other types of closures were used instead of Real-Time Closures, there would still be monitoring and enforcement costs, but the calculation and communication costs would be lower.

The VMS equipment is obligatory in all Scottish –indeed, in all EU – vessels over 15m length, which helps to keep monitoring costs low. If other fisheries were considering Real-Time Closures but did not have VMS already equipped on vessels then the setup costs of the scheme would be much higher. However, VMS has a range of benefits including safety, and so if such technology had to be installed then the costs would be apportioned across the different benefit streams.

In addition, some owners reported fuel and time costs of moving out from a closed area. It was noted that boats not targeting cod were still moved on, potentially moving away from a rich fishing area (Curtis et al 2009).

Any benefits of the scheme are harder to calculate. Firstly, benefits arise from better environmental status, and as been explained above this is likely to be quite small. Certainly, it has not been quantified in the literature. The other benefits would be the

financial benefits to fisheries and the fishing industry. Here, any calculation has to compare the scheme with a counterfactual baseline. The baseline cannot be a scenario with no fishing regulation at all given the strong EU policy background for cod quotas. Instead, the baseline is best seen as an increase in longer-term closures of fishing grounds to divert fishing effort, or a greater emphasis on specific gear use to protect certain stocks.

If the baseline costs are greater than the RTC costs, then the RTCs bring a benefit to the industry. Since both the longer term closure and gear options have been included in the CCS with a much lower voluntary take-up than the RTCs it can be seen that they are less popular with vessels. This is likely to be because the RTCs have a lower overall cost. Therefore, we could see the diversion of costs from these other options as a benefit of RTCs.

The fishermen also benefit from an increase in their quota of allowable days fishing. Although their overall landing quota does not change, the increase of time available allow for greater choice and efficiency for vessels.

#### 4.4.4.3 Suitability - Fit for use (context) and feasibility

The RTC scheme can be considered suitable for a context in which relatively little is known about fish stocks and movement, since the flexibility of both the closures and the scheme itself allows it to adapt to new information or demands. The number of changes that have been made to the scheme illustrate this.

The scheme is also suitable for the Scottish cod situation because the monitoring, communication and policy infrastructure was already there, so costs were lower. The region is large enough for there to be a number of closures in place at any one time but still provide room for fishing activities.

Dialogue between different parties involved helps balance or straighten out issues if the unsuitability is on one side. However, the process has not been entirely straightforward. The National Federation of Fishermen's Organisations (NFFO), whilst supporting RTCs, identifies "serious deficiencies in terms of a lack of transparency, communication and involvement". They also note problems arising if vessels or fishermen have to abide by RTC rules which they have not had a chance to help shape or develop. (NFFO, 2009).

The main aspect which is unsuitable is that the choice of target is currently unmeasurable since observers cannot know both the cod mortality if the scheme is not in place (the baseline), and neither can they know total fish catches since on-board observation is costly. Cod mortality has to be estimated by extrapolating the level of discards from sample observations, and not all information about the vessel's activities can be gained from the Vehicle Monitoring System<sup>181</sup>. However, this may change with time.

The RTC scheme is by its very nature flexible, and so should be applicable to other fishery contexts. The limiting factors of technology costs, data collection are likely to apply to other contexts unless technological innovation or falling costs enable better catch data.

The area of the North Sea in question is a 'boundary' between Scotland and Norway, and to a lesser extent England. Cross-border issues in the Scottish scheme have been mild since most evidence suggests non-Scottish vessels participate in the closures. In other seas with more numerous borders, such as the Black Sea or Baltic Sea there may be

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<sup>181</sup> VMS data can tell the location, course and speed of a vessel. Because vessels tend to trawl at a different speed to cruising, estimations can be made of what the vessel is doing but this is not known for certain.

greater difficulties in creating a scheme that different fisheries recognise or respect since there are more borders.

The Scottish scheme is highly data intensive, but this is not a large cost due to the existing infrastructure. Other fisheries may face larger investment and on-going costs to gather, process and disseminate the information necessary. VMS is a legal requirement for EU vessels over 15m in length.<sup>182</sup>

Stakeholder participation and dialogue is necessary – if there are more stakeholders in other areas, and even if they are all well organised, the more groups there are, the slower and less flexible the scheme will be. The social and institutional context is clearly important here, since if good relationships are not in place, the flexibility and easily-changed nature of RTCs could become a hindrance if acrimonious relationships bog the system down with impractical or awkward suggestions. Fishery organisations seem to give broad support to the RTCs (NFFO, 2009, SFF, 2010) so perhaps it is reasonable to conclude that the financial costs of RTCs are lower than alternatives such as long-term closures or mandatory gear adoption – this support seems more conditional upon the level of engagement they have with the policy process than the financial costs - so it could be useful to note that any policy implementation should have as much stakeholder engagement as possible.

Importantly, the Scottish system has treated inland waters within 12nm of the coast differently to the majority of the system – closures are smaller and require observed catch data to trigger a closure. In other contexts this could be more important, for example, most of the commercial fishing in the western region of the Black Sea takes place within the 12nm zone and so it is likely that care would have to be taken about applying RTCs there. However, enforceability is increased as foreign vessels are not allowed to fish within the zone.

It is likely that the greatest long-term difficulty of implementing a successful RTC in other areas will be the same difficulty as in the Scottish case. Without a clear and reliable method of assessing the impact on fish mortality, no scheme can be fully judged.

#### 4.4.4.4

#### Social, legal and institutional context

The CFP allows some flexibility for governments to choose methods for reaching given targets and the CCS is the specific legislative context for the RTCs in Scotland...

The Conservation Credits Scheme's system of regulating day's fishing rights allows the RTC scheme to have built-in costs for those who fish in closed areas. The CCS allots a quota of days which is in part based on which aspects of the scheme vessels have signed up to, but days can also be removed if vessels break their agreement (for example, by fishing in a closed area). This is a strength because the scheme can be "policed" within itself. In addition, the VMS data already being collected is suitable for monitoring the compliance with the scheme.

The institutional capacity for the RTCs already exists at political, industrial and research levels. That is, a number of governmental and non-governmental institutions already existed before the scheme that could support and develop the implementation and control of the RTCs. This includes the fishery organisations that represent fishers on the steering committee. Research capacity exists within governmental and academic institutions who collect and analyse data

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<sup>182</sup> [http://ec.europa.eu/fisheries/cfp/control/technologies/vms/index\\_en.htm](http://ec.europa.eu/fisheries/cfp/control/technologies/vms/index_en.htm)

The social acceptance is indicated by the fact that the measure was called for by a number of groups before it was first introduced, including fishery and wildlife organisations. There remains support and acceptance of the policy in broad terms. The scheme seems to have support from other nations who may be affected by the North Sea cod stocks, such as Norway and England. Evidence suggests that even when they are not obliged to, foreign vessels observe the closures.

#### 4.4.4.5 Flexibility and adaptability

The main strength of this scheme is that it is highly flexible and adaptable. With sufficient information and a strong institutional foundation, RTCs can be adjusted in many different ways. The nature of temporary closures being announced in real-time is welcomed by many as fish concentrations move constantly and are largely unpredictable. The measure was originally built for this flexibility, but the Scottish case shows that it can cope with changing demands (e.g. moving from targeting undersized cod, to spawning cod, to all cod), improved scientific knowledge (e.g. expanding the area as information about cod movement patterns is discovered) and socio-economic pressures arise (e.g. developing the 12nm).

The scheme is likely to be adaptable to a number of likely future scenarios. If cod stocks begin to rise again, the observation trigger would rise above the current trigger of 40 cod per hour's trawl to reflect the greater density of cod. Or, if stocks fall, then measures can be tightened.

#### 4.4.4.6 Broader impacts: risks and opportunities

RTCs were a popular policy before implementation amongst many groups. There is a risk that they provide less of an environmental benefit and more of a political benefit, since the environmental outcomes have not been definitively proven. However, the popularity is still strong, and other RTC schemes are growing, in part based on the Scottish scheme, such as the English scheme<sup>183</sup> and the juvenile RTC scheme in the North Sea.

The flexibility of the scheme remains a strong opportunity as so much remains uncertain about cod stock management. The scheme should remain robust to changes such as those brought on by climate change, by other marine policies, or economic changes. That is, it seems likely to be resilient to changes of different types and different levels.

#### 4.4.5 Enabling and limiting factors

Two studies in particular have looked at factors that are needed for success of the measure. Catchpole and Gray (2010) list seven factors required for the pilot schemes they assessed to be successful. These factors were based on previous literature assessing marine policies that have worked from various sources around the world. The seven factors were:

- A perceived crisis in the industry;
- Economic incentives;
- Stakeholder participation;
- Funding;
- Expert knowledge;

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<sup>183</sup> [http://marinemanagement.org.uk/fisheries/monitoring/closures\\_rtc.htm](http://marinemanagement.org.uk/fisheries/monitoring/closures_rtc.htm)

- Leadership;
- Enforcement.

They suggest that the pilot for Scottish RTCs had “largely met” factors 1-6 and 7 was not applicable as it was voluntary. As described above, it seems that amongst the voluntary participants, there is a very low level of noncompliance. Catchpole and Gray do not look at limiting factors though.

Bailey et al (2010) use the Scottish scheme and insights from other schemes around the world to give some key factors as well. They highlight the benefits of using **administrative penalties**, which saves time compared to using criminal penalties, and that the ‘real time’ nature works best within a **framework that is fast moving and flexible**, and the steering committee provides feedback and consultation between stakeholders that is suitable for RTCs.

Also, there are **technical limitations**, since landings are not the same as catches so data are not fully complete. However, more advanced technological solutions may be preferred from a theoretical or data perspective – even possibly sampling an identifying areas to close before vessels start catching there – but these would be very expensive. Increased use of on-board cameras may help.

The scheme is also limited by not having a **clearly defined measurable objective**.

**Complementary measures** to RTCs are primarily the other components of the Conservation Credits Scheme (CCS) scheme. Together, the whole scheme is designed to provide a flexible framework for the allocation of fishing days' quota - this quota can be increased as vessels opt in to various effort-reducing and effort-displacing options such as particular nets, other longer-term closures, and the RTCs.

#### 4.4.6

#### Conclusion

The RTC scheme in the Scottish North Sea has provided a flexible tool as part of a wider fishery policy. Whilst it is not completely proven to be successful and effective, it seems popular with stakeholders, researchers and policy makers, and has been applied in an increasing number of situations. Technology allows RTCs to be set up and monitored, but there is still a need for greater assessment techniques. It is highly likely that more RTC schemes will be used around the world, and with the right institutional frameworks, the flexibility and robustness of such schemes should allow for efficient and adaptable fishery management.



## 4.5 Marine Protected Areas in the Mediterranean: Medes Islands

### 4.5.1 Introduction

The Mediterranean is characterized by a great specific biodiversity, with a high rate of endemism, but it is ecologically vulnerable and has been subject to growing human pressures for centuries. The establishment of Marine Protected Areas (MPAs) is a measure aiming to provide long-term protection, enabling restoration and the careful use of this natural heritage. MPAs further contribute to increasing the productivity of fishing areas, to regulating the different uses of the sea, to fostering sustainable tourism and to creating new job-generating activities<sup>184</sup>. There are ca. 100 MPAs in the Mediterranean from which 41 demarcate no-take zone areas where all forms of exploitation are prohibited. Only 200 km<sup>2</sup> of the Mediterranean are fully protected no-take zone areas<sup>185</sup>. One Mediterranean MPAs has been selected to be subject to further assessment. This MPA is the Medes Islands Marine Protected area (and extended Natural Park as from end 2010 on) in Catalunya, Spain.

### 4.5.2 Environmental problem and objective(s) of the measure

Situated in the heart of the Costa Brava, Catalunya, the Medes Islands constitute one of the principal marine flora and fauna reserves in the Western Mediterranean.



Figure 4 : Location of Illes Medes at the Catalan coast, Spain (Source: Red Iberoamericana de Reservas Marinas, 2011)

The archipelago covers an area of approximately 23 hectares and is situated a mile off the Costa Brava. Marine resources have been exploited for years by fishermen; particularly coral fishers. The Medes Islands were listed as a marine reserve in 1983. Since then the area has seen a large recovery of its rich seabed and of many species previously in danger of extinction.

Main pressures that have been addressed and regulated by the MPA authority include fisheries and uncontrolled sailing, anchoring and diving. The case study focuses on the following scope:

- The **establishment of a Marine Reserve** and the “reserve” effect on fauna and flora.

<sup>184</sup> [www.medpan.org](http://www.medpan.org)

<sup>185</sup> IUCN, 2008, p.5

- Regulation of **underwater tourism** to control impacts and optimise its benefits as to co-finance the Marine Reserve (50% of the annual budget comes from diving fees, which represents the highest share in Europe) and therefore contributing to the conservation and improvement of the marine ecosystem and related resources.

### 4.5.3 **Measure: definition and context**

#### 4.5.3.1 **Legal background and implementation**

Protection of the marine area dates back to a Decree of 1983 which prohibits fisheries and the extraction of live marine resources in a zone of 75 meters around the islands. This protection was extended in 1990 to the conservation of sea-bed flora and fauna in the Medes Islands, establishing the Marine Partial Nature Reserve. In 2006 the area was designated as Special Protection Area for Birds (SPA) and Site of Community Importance (SCI) joining the Natura 2000 Network. Up to 2010, the Medes Islands Strictly Protected Zone covered an area of 93, 2 ha. An additional protected area of 418 ha stretches around the islands. In 2010, a law enlarged and transformed the protected area into a marine and terrestrial Natural Park allowing a more integrated regulation and protection of the area. The marine area has been extended to 2037 ha while a terrestrial (coast, river mouth and mountain) area of 6155 ha has been also included. This extension is important to improve the environmental status of the new protected areas, and to help lower the tourism pressure on the Medes providing sound alternatives in the field of nature based responsible tourism.

The following table reflects the activities allowed, prohibited or regulated at the Partial Marine Nature Reserve, its buffer zone and the Nature Park.

Table 15 : Activities allowed, prohibited or regulated at the Partial Marine Nature Reserve, its buffer zone and the Nature Park

Marine Activities	Natural Park	Buffer Zone	Marine Nature Reserve
Littering ; camping and lighting fires (on the beach and coast)	☒	☒	☒
Large scale fishing (trawling and purse seine fishing)	☒	☒	☒
To feed sea wildlife	☒	☒	☒
Underwater recreational fishing	Ⓡ	☒	☒
Surface recreational fishing	Ⓡ	Ⓡ	☒
Extraction of marine resources, spoiling animals and plants	Ⓡ	Ⓡ	☒
Small scale traditional fishing (trammel net and boulder)	☑	Ⓡ	☒
Diving (snorkeling or scuba diving)	☑	☑	Ⓡ
Anchoring	☑	☑	Ⓡ
Navigation	☑	☑	Ⓡ

☑ Allowed ; Ⓡ Regulated ; ☒ Prohibited

### Diving and water recreation

Each year an average of about 65.000 dives<sup>186</sup> take place in the Protected Area of the Medes Islands. This practice however, has negative impacts on benthonic organisms due to physic contact with flippers, body, hands or diving equipment<sup>187</sup>. This might constitute a serious problem when diving is developed in a MPA with a high rate of frequentation<sup>188</sup>. A 1990 law for the conservation of flora and fauna of the Medes Islands seabed established a set of measures to try and control these impacts: freezing the number of commercial licenses; limiting the number of daily dives to 450; establishing measures to control the number of dives; organising specific routes for cruise boats and setting up an evaluation committee as a body to discuss new measures to be introduced. For diving at Medes Islands, it is mandatory to obtain a specific license. Snorkelling is allowed without permit for individuals but organised groups do need authorisation. Only in 2009 there were 12.000 snorkelling outings through authorised centres.<sup>189</sup> Individual dives are the less numerous, about 3.000<sup>190</sup> in 2009, while most immersions are facilitated by 14

<sup>186</sup> Source; L'Estartit Tourism Office

<sup>187</sup> Zakai and Chadwick-Furman, 2002

<sup>188</sup> Sanchez J. et al, 2010

<sup>189</sup> Capellá J. 2009. Study based on data from the l'Estartit Tourism Office, the MPA and interviews to local operators.

<sup>190</sup> Ídem 15

accredited Centres. Other recreational activities include Sea Kayak and underwater and sea watching tours introducing the heritage of the area to the general public.

### Fisheries

The 2010 law establishing the Natural Park regulates professional artisanal fisheries in the Natural Park, albeit additional regulations which can come from the next Management Park.

Table 16 : Summary of the 2010 law establishing the Natural Park

Natural Park	Buffer zone (previous Marine Protected area)	Marine Reserve (former Protected Area)	Partial (former)	Natural Strictly
Art. 5.3 Prohibits: Trawling and purse seine fishing Aquaculture installations Fishing competitions Red Coral harvesting	Art 8 prohibits Trawling and purse seine fishing Aquaculture installations Recreational surface fishing with more than one rod/license Recreational underwater fishing	Art 7 prohibits All forms of fishing or marine resources harvesting and the possession of fishing gear. Mooring		
Allows: Traditional fishing (gillnet and long line) Recreational surface fishing with more than one rod/license	Allows: Traditional fishing (gillnet and long line) Recreational surface fishing with just one rod/license	Allows. Extractions of authorised scientific research		

Source: Jozami S. 2011

#### 4.5.3.2 Relation to other policy initiatives

The establishment of the Marine Protected Area at first and the larger nature park later on has been based upon international, European and national legislation and regulations in this field. It is especially based upon the implementation of the Birds and Habitats Directives and the establishment of the Natura 2000 network. Moreover, the Medes Islands were declared Specially Protected Areas of Mediterranean Importance (SPAMI) in November 2001. This legal figure is defined by the Barcelona Convention 1995 Protocol Concerning Mediterranean Specially Protected Areas and Biological Diversity in the Mediterranean (which replaced the 1982 Protocol Concerning Mediterranean Specially Protected Areas). The Protocol establishes the obligation to protect, preserve and manage these areas in a sustainable and wise way, in particular through the establishment of protected zones.

#### 4.5.4 Evaluation of the measure

##### 4.5.4.1 (Environmental) effectiveness

###### Goal achievement

The main objective of any MPA is the conservation of its natural heritage and its biodiversity. The Medes Islands were listed as a marine reserve in 1983. Since then the area has seen a large recovery of many sea and land species previously in danger of extinction. Species such as cattle egrets, little egrets and night herons have returned to the islands. The Medes Islands are home to one of the largest breeding colonies of Yellow-legged gulls in the Mediterranean. In addition, about 40% of the Catalan population of Shags nest on the Islands as well.

The reserve effect is especially significant on sea birds (since the terrestrial part is now inhabited) and sedentary fish species.

It can be stated that the MPA has met its objective of protecting vulnerable fish species and recovery populations even to the level of its carrying capacity; there is however evidence that the high frequentation and anthropogenic pressure brings negative impacts to *Posidonia oceanica* - a seagrass species endemic to the Mediterranean Sea- (mainly by mooring) and to red corals (diving and illegal harvesting).

Recreation, specially diving, represents a very important income for the village next to the reserve and diving taxes represent 50% of the MPA budget. The new plan will face the challenge of giving one more step to try and find the equilibrium between conservation and economic development, posing the weigh in conservation.

### Effectiveness in relation to GES (MSFD)

#### The Reserve effect

The area has been systematically monitored since 1990. This is one of the longest monitoring efforts in a MPA in the Mediterranean sea basin. The monitoring programme focuses on those fishes most vulnerable to fisheries efforts, red coral communities (*Coralium rubrum*), *Posidonia oceanica* fields, red gorgonian (*Paramuricea clavata*), crustaceans (as *Pinna nobilis*) and algae.

For the purpose of this case study three indicator species have been selected as they serve best to evaluate the regulation of fisheries (fish species), the impact of diving and poaching (red coral) and the results of mooring management (posidonia).

#### Fish organisms in rocky coastal waters

The monitoring of vulnerable species shows that the largest number of species is present in the Marine Partial Reserve (former Strictly Protected Zone, ZEP). It shows that the higher the degree of protection is, the larger the number of species present. Looking at the distribution of all highly vulnerable species, these are all presents at the ZEP, the area with the maximum protection, while some are absent in the other areas. It is worth highlighting the absence of the European seabass (*Dicentrarchus labrax*) outside the ZEP as well as the Dusty Grouper (*Epinephelus marginatus*) outside the Reserve Buffer Zone.

The “**reserve effect**” seems to be the main reason for the **differences in fish distribution in very vulnerable and vulnerable species** at Illes Medes and Montgrí coast. However, there are heterogeneous results between study zones within the same degree of protection. The differences in the habitats seem to be determining the distribution of species. The density of population is linked to the habitat type and extension. The monitoring also shows that the ZEP is reaching its carrying capacity of the studied vulnerable species, and populations are stable.

However, there are no clear positive results for the larger protected area when compared to the rest of the (unprotected) coastal zone. The prohibition of fisheries activities should result in an increase of population of the exploited species, but whereas this effect is clear in the ZEP it is not shown in the rest of the protected area. There is evidence of **illegal fishing** in this area which could be the cause of these negative results. Efforts on surveillance should be stressed.

#### Coral communities: indicator *Corallium rubrum*<sup>191</sup>

Red coral is a Mediterranean endemic species of high commercial, aesthetic and ecological value. The characteristics of Illes Medes and Montgrí coast marine bottom provides good conditions for the development of red coral populations easy to access when diving. This results on attracting thousands of divers a year, especially in the Marine Reserve, where there is a diving industry fully developed and established and is an important source of income of the local economy. However, this attractiveness poses difficulties for protection.

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<sup>191</sup> Pozo M., Reviriego B., Sardu S., Llop J., Mir F., Mora J. i Mena, I., 2009. “Seguiment de la Biodiversitat Marina a l'Àrea Protegida de les Illes Medes, la Costa del Montgrí i el Parc Natural de Cap de Creus 2009-2012. Informe resultats 2009.” Contract nº A 04.09.018 with Generalitat de Catalunya. Environment and Housing Department. Parks Service. Centre Balear de Biologia Aplicada, Mallorca, 390 pp

After almost 25 years of monitoring of red coral in the protected area, the results are not those which should be expected (increase in density, height and basal diameter) at no-exploitation zones. There are documented episodes of poaching up to 2005. This, together with the impact of divers, could be the reason for not obtaining a better evolution. These anthropogenic factors must be addressed by adequate protection and management measures.

Fields of marine fanerogams: indicators *Posidonia oceanica* and *Pinna nobilis*<sup>192</sup>

The *Posidonia* fields at Illes Medes and Montgrí coast show perturbations and low density. According to the optimum figures for the Catalan coast<sup>193</sup> they are classified as low density, with values between 25% and 50% in relation to the optimum density. One of the factors provoking this situation seems to be the water turbidity and the fact that the islands are just 3 km away from the Ter river mouth.

Monitoring of this field is recent and there are **no historical data** to compare and to determine whether the situation is stable. However, there is a clear difference between the areas where there is regulated mooring and those where the practice is for free. The **prohibition of anchoring** and the installation of ecologic mooring buoys within the Marine Partial Nature Reserve since 1990 have resulted in **less impacts on *Posidonia oceanica*** in this area where monitoring shows stability as to density and coverage as well as an increment of associated species as the fun mussel which are decreasing in other Mediterranean areas. Negative impacts are, however, visible in those areas of the Nature Park and Reserve Buffer Zone where anchoring is not yet regulated.

The indicator showing the effects of mooring is the density of fun mussel (*Pinna nobilis*). The census shows much lower density at those stations where unregulated mooring is allowed as compared to those where it is regulated. This should guide management measures as regulated mooring buoys and upper limits to the number of boats in the areas of highest frequentation.

Diving impacts on Descriptor 6 (seal-floor integrity)

Diving activities are of extreme importance for the Reserve as they bring revenue through taxes of ca. 50% of the annual budget of the Reserve. However, underwater tourism has an impact on caves, corals and gorgonians. The Park is trying to minimize this impact by working closely with companies providing diving services and training monitors into eco-briefing, meaning a briefing right before the immersion, already on the sea, about the potential impacts of the visit. For diving at Medes Islands it is mandatory to obtain a specific license. Dives are facilitated by accredited Centers .

There is a significant difference in the number of contacts between divers and biodiversity when there is an eco-briefing done before diving, resulting in fewer contacts.

Due to the impact of this increasing activity, it is essential to **calculate the carrying capacity of the Park** according to the type of habitats and establish upper limits of divers for the different areas, reducing the frequentation of the Reserve and regulating it better in the Park. Rotating zones is not advisable as once a community has been impacted the recovery is slow and its full recovery difficult. Most important, there is a need for a more strict surveillance and enforcement of the rules (regarding time tables, zones, numbers of

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<sup>192</sup> Idem 18

<sup>193</sup> Submon, 2009

divers, illegal mooring buoys, etc). In view of the formulation of the new Management Plan for the whole of the Nature Park, some experts<sup>194</sup> recommend, among other measures, to decrease the maximum number of divers in the Reserve and create new diving areas in the Nature park to decrease over-frequentation, to establish the obligation to use the services of guides and to make mandatory that guides and trainers have environmental education, and provide an eco-briefing prior to the immersion.

#### 4.5.4.2 Information on costs and benefits

The archipelago lies at less than a mile from l'Estartit municipality. At present more than 70%<sup>195</sup> of the Village's GDP is directly linked to tourism focused on the islands, mainly through diving, glass-bottomed boats and visits to the underwater trails. There are studies that have been conducted by the Tourism Office dating as from 2004, showing the financial benefits for the surrounding local communities of having the Reserve. At 2009 the economic impact is calculated to be over 10 million € for 2011<sup>196</sup>.

It is estimated<sup>197</sup> that the MPA has resulted in the creation of new enterprises and new jobs (16 new enterprises and 180 new jobs), the consolidation and loyalty of a new demand (ca. 70.000 pax<sup>198</sup>) and getting away from tourist seasonality by offering an attractive product for tourists 7 months a year.

The MPA raises about 50% of its annual budget from diving taxes (3,5 € per person/dive) which are estimated on an average of 227.000 € per year in the 2008 Management Plan. The Catalan government provides the remaining amount up to a total budget of ca. 450.000 € year. The new Management Plan 2012-2016 for the whole of the Nature Park will define the budget allocated according to the new dimensions of the protected area.

#### 4.5.4.3 Suitability – Fit for use (context) and feasibility

The historical limited extension of the Marine Reserve could have hindered the interaction with the nearby coastal area and resulted in a strong over frequentation of the MPA, with negative impacts on its ecosystem. The enlargement of the protected area with the terrestrial part and the qualification as a Nature Park (passing from ca. 500 to ca. 8.000 ha.) is an adaptation that might better serve the conservation and sustainable development objectives. It is early to assess how the new size will manage to contribute to distribute the pressure of recreation in a larger area and time scale as the Management Plan is now under development. Addressing the impacts of the tourism pressure is one of the priorities of the new plan and the evaluation will be possible in a few years' time.

We can consider the regulation of underwater tourism appropriate to the conditions but some negative impacts are still resulting from this practice. Adaptation measures include studies on carrying capacity and training and awareness of monitors and divers. Scientific community is almost unanimous when stating that diving pressure and impacts need to be further addressed and regulated in the new plan. As already mentioned, recreation

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<sup>194</sup> The team of the University of Girona which is doing an evaluation and provides recommendations for the Management Plan Revision consists of: Josep Lloret, Vanessa Rubio Mendoza and Toni Font Payeras

<sup>195</sup> Muñoz, 2006

<sup>196</sup> Capellà J. 2011, personal communication

<sup>197</sup> Muñoz N, 2006

<sup>198</sup> pax is short for visitors, passengers or clients in tourism business.

linked to the MPA, especially diving, represents a very important source of income for the village next to the reserve and diving taxes represent 50% of the MPA budget. The new plan will face the challenge of giving one more step to try and find the equilibrium between conservation and economic development, posing the weight in conservation and aiming to sustainability.

#### 4.5.4.4 Social, legal and institutional context

The MPA is established by law which also sets its management objectives. In this respect, the management measures are politically supported.

Preliminary opposition by the local population has been reported. In the case of Medes Islands, nowadays the municipality of Montgrí and village of L'Estartit fully support the MPA as a tool to protect their natural and cultural heritage at the same time that obtaining financial benefits. The main activities carried out in the protected area of the Medes Islands are directly linked to the observation of its natural marine heritage. Many enterprises organise scuba diving outings, commented underwater itineraries as well as boat trips around the Medes Islands protected area. Moreover, the area is of great importance to research; doctoral thesis, masters, and European programmes for the study of target species (sponges, gorgonians, red coral, lobster, etc) address this area.

In the new enlarged Natural Park the same human resources are deployed as in the former Marine Reserve. This is not sufficient in view of the new extension of the park (from 511ha to 8192ha) and new needs for surveillance, monitoring and maintenance. The Park counts 7 permanent staff and 4 additional staff during the high season (July and August). The current crisis situation has not allowed a new allocation of human resources which are expected in the future. Considering the results presented under the evaluation of the environmental effectiveness of the measure, it is clear that quite more resources need to be made available to surveillance. Innovative instruments as cooperation with the private sector or other government departments on surveillance issues could be implemented. This could e.g. be done by cooperation between fishermen and the coast guard.

#### 4.5.4.5 Flexibility and adaptability

The MPA is established by a law which sets its management objectives. There is however flexibility to establish the measures to reach those objectives. The Management Plan is to be revised every 4 years following and evaluation of the previous one enabling its adaptation.

#### 4.5.4.6 Broader impacts: risk and opportunities

The most serious risk posed to the MPA is that over frequentation and under surveillance result in larger impacts to the area, which will seriously affect its values and ecological sustainability. The Management authority is aware of this worse-case scenario which would not benefit the private sector, which very much depends on the reserve. There are therefore good expectations that agreements will be reached for the use of new tools and regulations that will help minimise the impact. Surveillance, especially over illegal fishing, illegal coral harvesting and mooring, should be stressed. It would be an opportunity to try and reach agreements with the private sector, especially with diving companies, to support on the surveillance and monitoring tasks as the MPA and its values is the basis of their business and they constitute one of the impacts received by the area.

The cooperation of artisanal fishermen could also be sought as it is mainly due to illegal fishing that the “reserve effect” is not noticeable outside the no-take zone. Stronger enforcement should result in increased fish populations from which they could benefit. The new extension of the Nature Park is further an opportunity to diversify the leisure offer and lower the pressure on the MPA, providing options for the terrestrial part or coastal areas within and outside the Nature Park.

At a Mediterranean level, the effort of different MPAs should be coordinated. MPAs should look for commonly agreed measures and solutions to key shared problems in order to avoid that pressures pass from one to the other. Illes Medes is working in this direction in the framework of the MedPan network and their role in the MedPan North project co-funded by the European Regional Development Fund. The project started in July 2010 and runs until June 2013. The aim of the MedPAN North project is to improve MPA management effectiveness, including the marine Natura 2000 sites and to contribute to the establishment of a network of MPAs, as part of the international commitments, and particularly the European commitments in this area.

#### 4.5.5 Enabling and limiting factors

The establishment and management of MPAs in general requires some enabling factors without which its real effectiveness would be very limited. To the purpose of this study these have been grouped in the following categories which also reflect to some extent their order of importance:

- Legal and institutional Framework: to create legislative conditions and a strong legislative framework. In EU countries the implementation of related EU directives triggers this process.
- Strategic planning and management: this set of factors would include the need to agree with all relevant stakeholders on an adequate and implementable Management Plan, addressing key conservation objectives; make sure to establish a good mechanism of surveillance to ensure respect to regulations; make sure that monitoring of the effectiveness of the measure is carried out well, in order to evaluate and improve management and be aware of the sufficient scale of implementation
- Financial and socio-economical: Be aware that the measure must have a positive impact on major economic sectors or at least does not harm them; try and keep the costs of implementation low and consider the use of taxes on recreational activities in the MPA as a potential source of income.
- Public acceptance and ownership: Creating public acceptance through communication, awareness, participation, conflict resolution and agreements; stress ownership of the measure (both by the MPA manager and society); emphasize the socioeconomic benefits for the local communities, and proof that by means of research and monitoring.

Once an MPA has been established special attention will need to be given to limiting factors which might hamper its effectiveness as for example:

- Lack of historic monitoring data or incompatibility with new monitoring methodologies;
- Lack of proper surveillance (and the difficulty/cost to carry it out on sea) can affect the effectiveness to conservation measures

- Illegal behaviour in protected areas hamper not only the conservation and recovery of the area but affect the reserve effect in the adjacent zones as well.
- Recreational activities based on natural heritage (as diving) must be regulated in a way that the conservation objective is prioritised and the impact of the activities minimized.
- Opposition of economic sectors, especially fisheries.

#### 4.5.6

#### Conclusion

The Reserve constitutes a model to understand the evolution of natural systems in a zone where certain activities are prohibited.

In the case of Medes Islands it can be stated that the MPA has met its objective of protecting vulnerable fish species and recovery populations even to the level of its carrying capacity; however, this effect is not seen outside the strictly protected zone. The lack of “reserve effect” outside these limits is, most possibly, due to illegal fishing practices in the buffer zone and Nature Park. A larger effort in surveillance is therefore needed.

Water and underwater recreation is an opportunity for marine reserves, regarding economic benefits (through taxes), integration in local economy bringing benefits, and education and awareness. In the case of Medes Islands, diving represents a very important income for the village next to the reserve and diving taxes represent 50% of the MPA budget. There is evidence however that the high frequentation and anthropogenic pressure brings negative impacts to *Posidonia oceanica* (mainly by mooring) and red corals (diving and illegal harvesting). The prohibition of anchoring and the installation of ecologic mooring buoys within the Marine Partial Nature Reserve since 1990 have resulted on less impacts on *Posidonia oceanica* in this area where monitoring shows stability as to density and coverage as well as an increment of associated species as the fun mussel which are decreasing in other Mediterranean areas. Negative impacts are however visible in those areas of the Nature Park and Reserve Buffer Zone where anchoring is not yet regulated. These anthropogenic factors are to be taken into account when agreeing on the new regulations for the management of the area (Management Plan 2012-2016). The new plan will face the challenge of giving one more step to try and find the equilibrium between conservation and economic development, emphasizing conservation.



## 5 Conclusions and recommendations

In the framework of this study, a toolkit has been developed consisting of a **database** of +/- 140 policy measures in an Excel format, structured by sectors (drivers), impacts and pressures and objectives (GES). Member States can make a targeted search for measures suited for their own implementation of the MSFD. The inventory is based on a review of published literature as well as interviews with a large number of relevant institutions, aimed at gathering any available (also unpublished) information about specific instruments and their evaluation. It includes measures that are already implemented in the EU or in countries that are, to some extent, comparable to the EU in terms of environmental, economic, social and institutional settings. The inventory also discusses measures that have not yet been implemented for the marine area, but that could be suited to it.

A limited set of measures from the database has been briefly assessed *ex ante* according to the following set of **evaluation criteria**:

- (Environmental) effectiveness of the policy,
- Costs and benefits (cost-effectiveness analysis, cost-benefit analysis),
- Suitability,
- Social and institutional context (capacity, legal basis, equity and fairness),
- Flexibility and adaptability and
- Timing issues.

The assessment has been qualitative and based upon expert judgment and a review of relevant literature. Moreover, **key success and limiting factors** that would be needed for (a mix of) measures to be cost-effective and flexible have been identified for each (group of) measures, based on desk research.

The evaluation criteria and the success and limiting factors have been tested by evaluating 5 case studies, more specifically policy measures already in place in the EU:

- NOx-tax and NOx Fund (Norway)
- Aggregates Levy (UK)
- No Special Fee system for ship-generated waste collection (Baltic Sea)
- Real Time Closure scheme for fisheries (Scotland)
- Marine Protected Areas (MPAs) (Medes Islands in Spain)

In the following section, the *ex ante* evaluation results and anticipated success and limiting factors are discussed based on evidence found in the case studies. This work has led to the following conclusions on when and under which conditions the different measures and policy mixes for the main marine situations in EU would prove more useful and appropriate.

### ***A clear environmental goal and robust measurement is important***

When deciding on policy instruments to tackle environmental problems or increase the level of environmental protection, a key priority lies in achieving the desired **objectives**. Evaluation therefore needs to assess whether progress has been recorded towards the defined objective (target achievement) and the degree of contribution of the policy measure to that result. This means that the existence of a **causal relationship** should be revealed between the effect and the policy instrument, and whether similar effects would not have occurred under a business-as-usual scenario (additionality).

It is thus important to clearly state the goals which the measures should aim at and by means of which **robust measurements** distance-to-target should be followed up. This allows a proper evaluation of the policy measure and intermediate adjustments where necessary.

At the time of the creation of the **NOx Fund**, the Environmental Agreement between the Business Organisations and the Ministry of Environment agreed on absolute emission reduction targets over the period of the first agreement 2008-2010. Undertakings that received exemption from the NOx tax committed to (collectively) decrease NOx emissions by +/- 30,000 tonnes in that period (corrected downward to 18,000 tonnes). The NOx Fund has met these emission obligations.

The **Conservation Credits Scheme (CCS)** has the aim of making sure that whitefish stocks in Scottish waters can recover to sustainable levels, specifically by lowering instantaneous cod mortality by 25% from 2008 to 2009. Measures set up by the scheme included the original **Real Time Closures**, but also other measures (such as voluntarily / permanent and seasonal closed areas).

. The success of the Real Time Closures would fundamentally need to be assessed in relation to how much they can contribute towards the more general CCS target of 25% reduction. However, it has proven to be very difficult and expensive to assess cod mortality changes since data concerning discards are limited. In this way, a severe weakness of the measure is the **lack of a robust measurement** to evaluate progress or failures. Evaluation of Real Time Closures in Scotland showed that catch savings (decrease in mortality) were found, but less than expected. This could be due to weaknesses in the current ability to assess cod mortality, but it could also be that the nature of the scheme is to divert effort rather than reduce it or eliminate it.

The overall objective of the **No Special Fee** system (and the wider Baltic Strategy) comes down to reducing the pollution from shipping waste, by facilitating reception of waste and providing incentives to delivery on-land. These targets could be further translated in terms of amounts of pollution / garbage at sea or delivery of waste to reception facilities in ports. Another target is to decrease both the number of instances of illegal discharges and the amount of pollutants discharged. There is however a lack of reliable statistics to measure these targets (because reporting of waste quantities delivered is not mandatory nor exhaustive as many private handlers do not report waste amounts). In the case study an evaluation is done for three ship-generated waste categories with information from individual ports but without giving a complete overview. The system is believed to contribute to increased delivery of wastes in ports.

***Complex environmental processes in marine systems require spatially specific design to be environmentally effective, with more research to be oriented on this aspect***

In the framework of the MSFD, it is important to further clarify the relation between the recorded results and the potential **progress towards GES for the relevant descriptors**. Potential influences should be considered at least qualitatively and it is also advisable to pay attention to potential negative impacts on (other) GES-descriptors while aiming at improvements in certain axes. The case studies have shown that these interconnections are difficult to establish, for multiple reasons.

The environmental processes in marine systems are **complex** by nature. The relation between actions or changes and the state of the marine environment is often multiple and not direct. The impact of pollution is affected by factors such as differing levels of salinity, different rates of mixing in the water column and water temperature. The marine environmental impact of a policy measure also depends on the mixing and the existing level of nutrients (i.e. the NPK balance<sup>199</sup>). Mixtures of pollutants have been shown to have differing impacts on marine organisms.

Input of nitrogen adding to eutrophication can be reduced by decreasing **NOx-emissions** from large contributors, however the effect on the marine environment is difficult to monitor and assess. Pollution through NOx has a residence of a few days so pollutants can be transported over a certain distance and the policy instruments might not immediately contribute to GES in the own marine environment (temporal and spatial scale of effects).

One of the difficulties with evaluating **Real Time Closures** is that whereas the aim is reduced mortality, the Real Time Closures can displace fishing effort and in this way do not necessarily affect total effort. There is also a chance that by diverting away from the species aimed at, other species may be adversely affected.

These complexities pose important issues for the design of appropriate policy in the allocation of the burden of the damage cost to the pollutant in the case of environmental taxes and in the identification of the appropriate command and control measure to address any given marine pollution issue.

The base of **scientific knowledge** on the seas is generally considered to be **lower** than that on limnetic and riverine systems. The need is clearly identified for more research on the complex environmental processes in the marine system and the link with policy design.

This means that depending on the local characteristics of the marine waters, different measures may be more or less environmentally effective (or cost-effective). Therefore, the importance of the **spatial specificity** is key for the right policy options. Transfer of measures from one context to another will not necessarily yield the same benefits or results. Decisions must be considered in light of the own situation and carefully take note of the reasons why a measure can or cannot work. From this perspective, it is highly important to learn from experiences in other MS, but it should be born in mind that a simple copy will often not work.

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<sup>199</sup> Referring to the important nutrients Nitrogen (N), Phosphorus (P) and Potassium (K). In different coastal waters of the EU, additions of different nutrients may be important in altering the species mix and quantity of algae present.

***Open access poses a threat to successful implementation and calls for common systems on a broader scale***

Marine environments are characterised by an open access, with a risk of **transboundary pollution movement** leading to specific issues when drafting and implementing policy instruments (e.g. impacted population is not in the same jurisdiction as the pollution source). The lack of property rights or allocation of temporary rights for the use of the seas poses a threat to the successful implementation of policies to improve the marine environment. This lack may affect the environmental effectiveness of policy instruments targeting particular types of users of marine space, as other users may move into these areas and in this way negatively influence the environmental status.

Indispensable for some economic instruments in order to be effective, is the presence of **common systems on a broader scale**. Lessons could be drawn from the pollution haven hypothesis, with a pollution haven arising if stringency of environmental standards differs between countries and lower standards become a source of comparative advantage. This phenomenon holds the risk of a “race to the bottom” with countries mutually competing environmental standards down in order to capture economic benefits. This may be particularly relevant for instruments targeting shipping.

However, regional harmonization may bring a number of **organisational challenges**. The installation of a new Executive Body may be required, which may be difficult to implement depending on the regions involved and the instrument (e.g. more difficult for fee-based measures).

For certain policies to be more (cost-) effective, there is even a clear need for **international cooperation** e.g. Convention for Control and Management of Ships’ Ballast Water and Sediments. This cooperation may imply costly and potentially lengthy negotiations (specifically when international), but there is also a clear potential of cost-sharing. Member States can share the high costs of certain technological measures when they are organised at the appropriate scale e.g. disaster management, surveillance activities or some monitoring systems.

In the framework of different **Marine Protected Areas** (MPAs), the efforts could be coordinated in a sense that MPAs should look for commonly agreed measures and solutions to key shared problems in order to avoid that pressures pass from one region to another.

The incentive of the **No Special Fee** system to encourage waste delivery on land is hindered by the imperfect implementation and different interpretations across countries in the Baltic, limiting e.g. the amount and types of waste that can be delivered under the system. This diversity in implementation, aggravated by varying levels of adequacy of port reception facilities have not overcome the uneven waste flows (and associated waste costs) between Baltic ports. The case made clear that despite the large efforts on the legal framework controlling discharges from ships, the prevention of pollution can only work satisfactorily if all the involved actors work together and take their particular responsibility. For cost recovery systems to provide incentives to deliver waste, it is important that no port includes any financial disincentive to use waste reception facilities. But for the system to be really effective, it should preferably be harmonised over a wider geographical area, although the competitive environment where ports and ships are operating does not facilitate the further harmonisation of any fee system.

### ***Strong design and effective legal framework are essential***

The case studies clearly showed that a strong design of measures and an effective legal framework are essential in the marine context, which is likely to be compounded by the multiple uses of the marine environment. This implies the need for clear departmental responsibilities and coordination between marine departments and e.g. defense, energy, tourism and fisheries. Besides, there is the need for cross-compliance with and in other environmental policies. It is important that other objectives of EU policy be implemented consistently with the MSFD and that potential “win-win” measures be identified when implementing e.g. the Water Framework Directive or the CAP. If not taken into account, the risk exists that other policy instruments may limit the impact of the specific marine instrument. It is important that policy makers develop a well-considered mixture of policies to implement the MSFD, while taking into account the existing measures.

The **Aggregates Levy** was designed to be simple and applicable broadly, rather than to achieve specific marine outcomes. In addition to the Levy, a Sustainability Fund was developed. The Fund had a strong and flexible design which helped it meet early objectives of encouraging recycling and later objectives of wider research. In aiming at increased recycling of aggregates, the Levy shows overlaps with other policies e.g. the Landfill Tax. The tariff of the Aggregates Levy is relatively small compared to the Landfill Tax and industry suggests that the impacts of the Levy in this regard are negligible. The Levy’s design has left it open to challenges (court action challenging the Levy itself) since not all quarrying is covered. The cancelling of the Sustainability Fund also suggests that the Levy is not focussed on environmental considerations.

### ***There is a potential of revenue recycling of fee-based instruments to increase efficiency and policy acceptance***

The integration of external costs through environmental taxation into the decision making of marine users creates the potential for increased efficiency in the tax system. In order to maximise direct impacts of fee-based instruments on the marine environment, it is recommended that **revenues** are used to improve the environmental conditions of coastal waters.

In the **Medes MPA**, (underwater) tourism is regulated (on the basis of the conservation principle) and made use of as an instrument to co-finance the MPA to contribute to the conservation and improvement of the marine ecosystem and related resources, resulting in economic benefits for the area.

The revenues may also be used for generating other environmental benefits, however **without** having a **direct impact** on the marine environment.

As a marine policy instrument, the UK **Aggregates Levy** can be considered inflexible since the level is not set to specific marine contexts, and as marine extraction makes only 20% of total UK aggregate production, it is reasonable to expect that the Levy will never fully incorporate marine environmental costs. The evidence shows that the Levy has indeed not seemed very suitable as a means of lowering the environmental impact of dredging by altering dredging quantity or quality.

However, the Levy has raised monies for a Sustainability Fund which has generated useful knowledge for the marine extraction sector to improve its environmental

performance (and in this way the measure has potential to indirectly improve environmental quality – however this may be axed at land and not at the marine environment - provided that the knowledge is put into practice). The research outcomes will continue to support policy making and licensing into the future, and to encourage more environmentally beneficial behaviour, even after the Fund's closure.

Even if emission payment schemes are generally efficient from a social welfare point of view (by internalising associated external costs), political viability often depends on the distribution of the costs and the varying degrees of opposition. Revenue recycling within the group of polluters may also increase the **acceptance** of the policy.

The **NOx Fund** may be considered as a non conventional example of Refunding of Emission Payments, as it is a combination of a tax exemption and refunding of contributions to the Fund. The setup as a cooperative – business organised - effort combining sectors with different abatement curves has created the possibility to maximise cost-efficiency.

### ***An early involvement of key stakeholders is important***

Lack of consultation of key stakeholders and lack of political acceptability are likely to be a major issue in the marine context, where there is open access and the need for self-regulation because of the difficulties of monitoring in many marine contexts.<sup>200</sup> Communication may need to be across sectors and country boundaries to be effective.

Regarding the **NOx Fund**, spreading of information has been a crucial factor of success in the initial period as well as in the operational phase. The Fund has organised multiple information meetings with active participation from all stakeholders. The introduction of the NOx Fund has been widely accepted by the different sectors affected by the NOx tax in Norway, as more than 90% of all registered enterprises subject to the tax and about 95% of taxable emissions have endorsed the Environmental Agreement.

The Scottish **Conservation Credits Scheme** has set up a steering group that meets monthly to provide direction and input from all stakeholders. It is involved in key decisions such as adjusting various parameters. It provides a voice for all major stakeholders and allows the policy to be flexible and relevant. The Real Time Closure measure was called for by a number of groups before it was first introduced, including fishery and wildlife organizations; there is a good acceptance of the policy from stakeholders.

The main quarrying and aggregate industry organizations have not accepted the **Aggregates Levy** in the UK, as demonstrated by the legal challenges.

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<sup>200</sup> Open access resources are potentially subject to over-exploitation through the "tragedy of the commons". In the marine context, there is particular need for self regulation of users because of the number of users and the costs and feasibility of monitoring. This implies there needs to be "buy in" on the part of stakeholders to ensure implementation of measures.

### ***Provision of sufficient lead time increases cost-efficiency***

Costs of policies to support the implementation of the MSFD may differ significantly, depending on the measures, locations and technical specifications of the policies. The timeframe within which the assessment is done also plays a role: a certain measure may imply losses/costs in the short term, but it can create welfare gains in the long run. Returning the marine environment to good environmental status will take time anyhow, because of the long time periods involved. Depending on the time lag between the implementation of a measure and its effect on the GES, different measures can be cost-effective at different moments in time. Related to this, it is important to provide sufficiently long **lead times** on implementation, i.e. by giving adequate prior notice to industry of policy measures. These are important to enable effective implementation of policy at lower cost to industry and hence, increasing the potential for “win-win”. Economic instruments (especially taxes and charges) should be announced well in advance and should involve consultations with stakeholders. This will enable actors to take account of the instrument in their decisions and to react optimally to the changed conditions, thus improving overall efficiency.

The **NOx tax** was introduced to reduce Norway’s emission of NOx as the national emissions were too high and was not accompanied by a Fund in the year of introduction. According to the Fund, the tax introduction should have been better timed and communicated to the target group. This could have enabled actors to take account of the instrument in their decisions and to react optimally to the changed conditions, thus improving overall efficiency. The tax without economic compensation from the Fund impacted on margins of fisheries and the delayed introduction of the Fund most likely postponed the process of investing in more environmentally friendly technologies.

### ***High administrative costs should be avoided and enforcement capacity available***

A strong design of measures also necessitates the avoidance of high administrative costs which may otherwise lead to excess compliance costs. It is also essential that sufficient **capacity** is available in order to implement and **enforce** the measures envisaged. Ensuring stakeholder engagement and acceptance is essential for the implementation of measures where enforcement is likely to be difficult.

With its simple design, the **Aggregates Levy** in the UK can be calculated relatively easily from records companies must keep anyway, ensuring cost-efficient administration. It is administered by the HMRC (Her Majesty’s Revenue and Customs), a non-ministerial department of the UK Government responsible for the collection of taxes and the payment of some forms of state support; this guarantees a strong enforcement.

The administration costs of the Scottish **Real Time Closures** include negotiations over the continual adjustment of key parameters, but in general with the infrastructure in place already, regulating costs have been proved to be rather low. The investment and on-going costs to gather, process and disseminate the information necessary can be considerably higher in regional seas which do not have the existing technology. It is interesting to note that in the Scottish Conservation Credits Scheme the system of buying back or removing days’ fishing rights allows the Real Time Closure scheme to have built-in costs for those who fish in closed areas. This is a strength because the scheme can be “policed” within itself.

The administrative costs of operation and control of the **NOx Fund** have been rather low because the opportunity was taken to link with an existing legal framework relating to Special Taxes. The NOx agreement between business and the Authority has in fact transferred (a significant) part of the control to the NOx Fund. The Fund has an obligation to meet a collective reduction target and individual undertakings sign a participant agreement with the Fund stating rights and obligations between both parties. First line reporting and control is organised by the Fund. The Fund is assisted by a third party to control real emissions, Det Norske Veritas (DNV). In the period 2007-2011, the NOx Fund has about 2% administrative costs covering own expenses for administration and purchased services from mainly DNV. The cost of running the fund can currently be covered by interest payments on contributions to the fund.

The need for adequate staff numbers to enforce **Marine Protected Areas**, which may be the subject of poaching.

### ***It is important to identify "win-win" measures***

Although certain barriers may exist to their implementation (e.g. information or educational barriers), there is a clear potential of "win-win" solutions under the implementation of policy to support the MSFD, i.e. cost savings could be achieved in reaching environmental objectives. A number of examples could be identified from the database, though further research is encouraged:

- a fair sized marine protection area where there may be potential for revenue capture to cover the costs and for gains to fisheries from increased fish yields;
- alternative shipping lanes;
- use of green lights instead of red and white light (oil platforms) for migratory birds (potential to integrate in licensing procedures);
- larger mesh sizes and innovation in selective fishing methods (provided that profitability of fishermen is not reduced);
- preventative measures to reduce loss of fishing gear: biodegradable nets, deposits and name tags on fishing nets;
- energy savings in shipping leading to reduced emissions and costs;
- ecolabelling of marine products and tourism (provided that the price premium is high enough);
- the use of marketable filter feeders (e.g. mussels) around fish farms to reduce the impacts on the marine environment.

### ***A balanced policy mix increases environmental and cost-effectiveness***

A mixture of policies is needed to implement the MSFD, as not one instrument impacts on all categories of GES. Using combinations of measures is also likely to lead to more cost-effective outcomes. Combining traditional command and control instruments and rather innovative social and technological instruments may assist in ensuring more effective environmental outcomes. This is likely to be particularly true in the implementation of the MSFD, because of the competing uses of the seas. Additionally, social measures may positively impact on the outcomes of economic instruments and command and control measures.

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(1) Consultancy, study and design of buildings, infrastructure, environment and environmental planning. Outsourcing of project staff on site.  
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